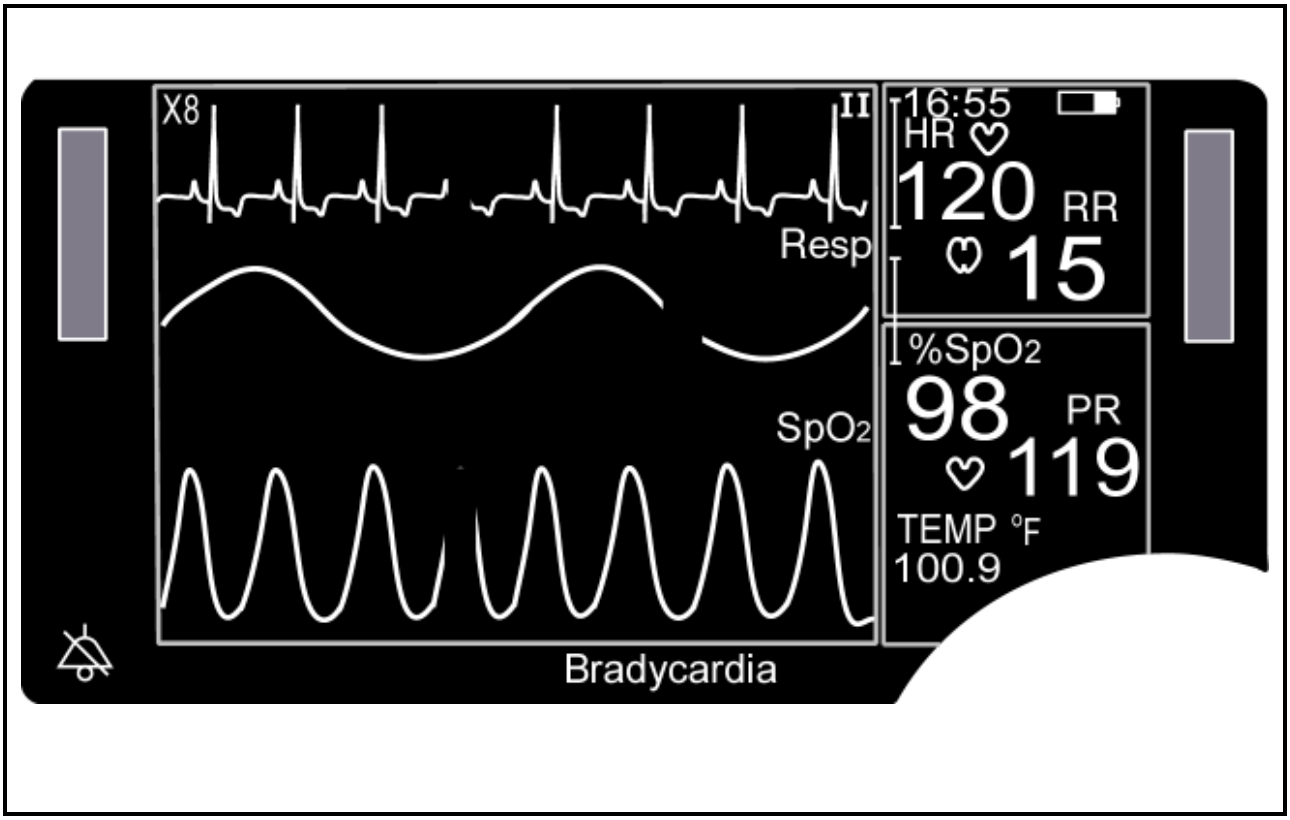
Midmark

Veterinary Vital Signs Monitor

Models 9454 and 9456



User's Manual

Manufactured for:

CASMED
FOR WHAT'S VITAL

MIDMARK®

21-02-0187 REV. 05 3/15

Midmark
Veterinary Vital Signs Monitors

IMPORTANT:

This manual addresses all parameters of the Midmark Veterinary Vital Signs Monitor. Not all monitors have all the parameters referred to in this manual.

Read this Manual completely before using this equipment.

WARNING:

The Midmark Monitor is to be operated by qualified personnel only. Before use, carefully read this manual, including accessory directions for use, all precautionary information, and specifications. The user must check that the equipment functions safely and see that it is in proper working condition before being used.

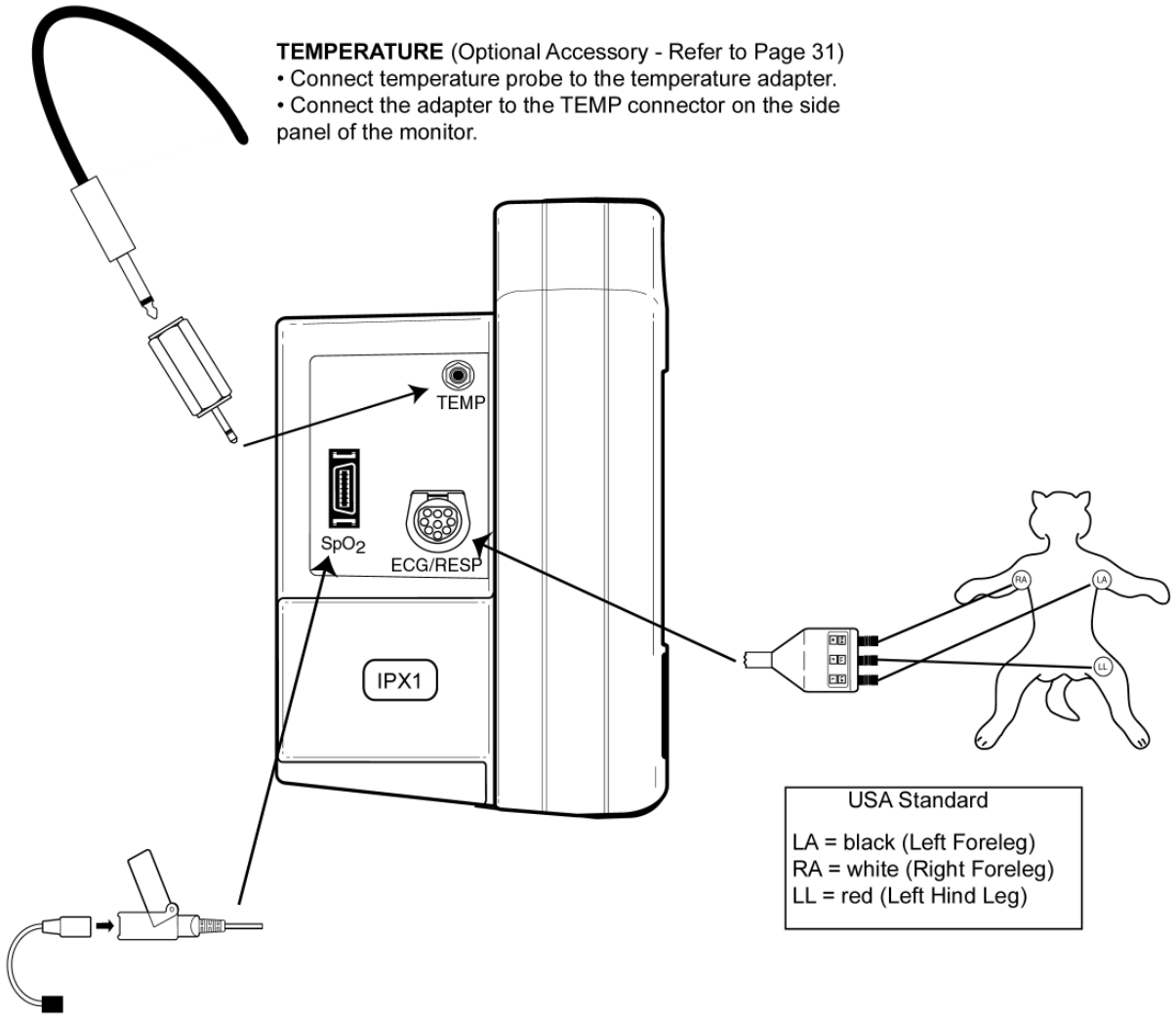
In the U.S. the following Caution applies:

CAUTION:
Federal law restricts this device to sale by or on the order of a veterinarian.

First Printing: 05/2004
Revised: 09/2004
Revised: 05/2005
Revised: 05/2008
Revised: 05/2009

QUICK START-UP GUIDE

PATIENT CONNECTIONS



TEMPERATURE (Optional Accessory - Refer to Page 31)
• Connect temperature probe to the temperature adapter.
• Connect the adapter to the TEMP connector on the side panel of the monitor.

PULSE OXIMETRY (Model 9454 - Refer to Page 27)
• Select the small or large veterinary sensor and attach to the sensor clip.
• Apply sensor clip to the patient's tongue.
• Connect the sensor to the interface cable and lock hinged cover into place.
• Connect the interface cable to the SpO_2 connector on the side panel of the monitor.

ECG (Refer to Page 19)
• Attach the 3 lead or 5 lead patient cable and leads per the diagram. Leads may need to be moistened with isopropyl alcohol to optimize contact.
• Connect lead wires to patient cable by matching colored ends with colored block on cable.
• Connect round end of patient cable to the ECG/RESP connector on the side panel of the monitor.

QUICK START-UP GUIDE

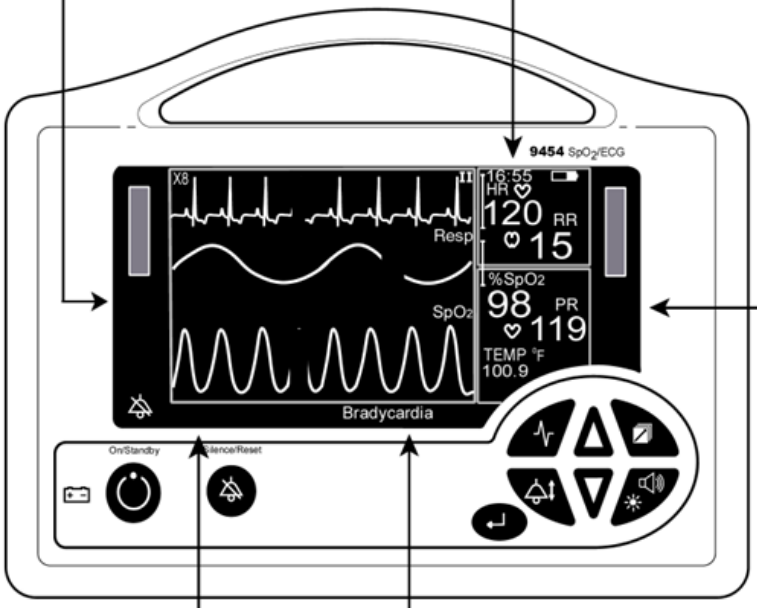
MONITOR OPERATIONS

MAIN DISPLAY AREA
• Up to 3 traces can be selected in the Parameters Menu. Trace #1 is automatically an ECG waveform.

• This section also displays various menus when selected.

TOP RIGHT SECTION
• Current monitor time and battery charge status are displayed.

• Trace #1 and #2 waveform names, numeric values and flashing visual icons are displayed.



LOWER RIGHT SECTION
• Trace #3 waveform name, numeric value and flashing visual icon are displayed.

• Temperature (if in use) is displayed.

EQUIPMENT MESSAGES
• Displays the current status of the Audio Alarm Silence, when selected.

PATIENT ALARM MESSAGES
• Text section displays any patient related alarm messages.

QUICK START-UP GUIDE

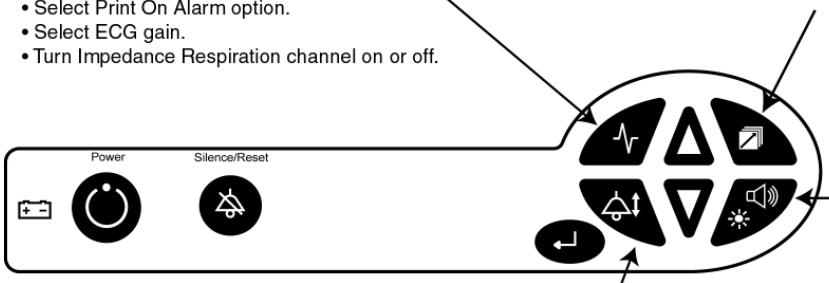
MENUS

SETUP (Refer to Page 43)
Depress and hold ALARM LIMITS and AUDIO/VISUAL buttons while turning the monitor on.
- Set the Operating Language
- Make selections for Audio Alarm Silence
- Set Date, Time and Daylight Savings options
- Set SpO2 Alarm Delay Time
- Select Temperature units
- Select Trace Background

PARAMETERS (Refer to Page 49)
Press Parameters pushbutton.
- Select and configure the ECG waveform in Trace 1 area.
- Select and configure the waveform to be displayed in Trace 2 area.
- Select and configure the waveform or history data in Trace 3 area.
- Select print speed.
- Select Print On Alarm option.
- Select ECG gain.
- Turn Impedance Respiration channel on or off.

HISTORY (Refer to Page 52)
Press the History pushbutton to recall stored Trend History.
- Recall a list of one minute averages of data values.

Press and hold History pushbutton again to recall Alarm History.
- Recall list of alarms that have occurred.



AUDIO/VISUAL (Refer to Page 51)
Press Audio/Visual pushbutton.
- Adjust Alarm volume.
- Select source of audio "beep".
- Adjust "beep" volume.
- Select audible key click option.
- Adjust screen contrast.

PATIENT ALARMS (Refer to Page 58)
Press Alarm Limits pushbutton.
- Change alarm limits values of any parameter.
- Save alarm limits for future use.
- Restore a previously saved set of limits.
- Restore factory defaults.

Manufacturers Declaration of Conformity
Electronic Emissions and Immunity

The Model 9454/9456 Monitor is intended for use in the electromagnetic environment specified below. The customer or the user of the Model 9454/9456 Monitor should assure it is used in such an environment.

Emissions Test	**Compliance**	**Electromagnetic Environment**
RF emissions – CISPR 11	Group 1	The Model 9454/9456 Monitor uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions – CISPR 11	Class B	The Model 9454/9456 Monitor is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class B	
Voltage fluctuations / flicker emissions	Complies	

Immunity Test	**IEC 60601 Test Level**	**Compliance Level**	**Electromagnetic Environment Guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	+/-6 kV contact +/-8 kV air	+/-6 kV contact +/-8 kV air	Floors should be wood concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	+/-2 kV for power supply lines +/-1 kV for input/output lines	+/-2 kV for power supply lines +/-1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	+/-1 kV differential mode +/-2 kV common mode	+/-1 kV differential mode +/-2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage Dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	< 5% U_T (>95% dip in U_T) for 0.5 cycle. 40% U_T (60% dip in U_T) for 5 cycles. 70% U_T (30% dip in U_T) for 25 cycles. < 5% U_T (> 95% dip in U_T) for 5 seconds.	< 5% U_T (>95% dip in U_T) for 0.5 cycle. 40% U_T (60% dip in U_T) for 5 cycles. 70% U_T (30% dip in U_T) for 25 cycles. < 5% U_T (> 95% dip in U_T) for 5 seconds.	Mains power quality should be that of a typical commercial or hospital environment. If users of the Model 9454/9456 Monitor requires continued operation during power mains interruptions, it is recommended that the Model 9454/9456 Monitor be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: U_T is the A.C. mains voltage prior to application of the test level.			

Guidance and Manufacturer's Declaration – Electromagnetic Immunity

The Model 9454/9456 Monitor is intended for use in the electromagnetic environment specified below. The customer or the user of the Model 9454/9456 Monitor should insure that it is used in such an environment.

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment - Guidance
			Portable and mobile RF communications equipment should be used no closer to any part of the Model 9454/9456 Monitor, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance:**
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	$d = 1.2\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 800 MHz to 2.5 GHz Where *P* is the maximum output power rating of the transmitter in watts according to the transmitter manufacturer and *d* is the recommended separation distance in meters. Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey [a], should be less than the compliance level in each frequency range. [b] Interference may occur in the vicinity of equipment marked with the following symbol:

NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is effected by absorption and reflection from structures, objects and people.

[a] Field strengths from fixed transmitters, such as base stations for radio (cellular / cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Model 9454/9456 Monitor is used exceeds the applicable RF compliance level above, the Model 9454/9456 Monitor should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the Model 9454/9456 Monitor.

[b] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the Model 9454/9456 Monitor

The Model 9454/9456 Monitor is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the Model 9454/9456 Monitor can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Model 9454/9456 Monitor as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter (Watts)	Separation distance according to frequency of transmitter (Meters)		
	150 kHz to 80 MHz $d = 1.2\sqrt{P}$	**80 MHz to 800 MHz** $d = 1.2\sqrt{P}$	**800 MHz to 2.5 GHz** $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters operating at a maximum output power not listed above, the recommended separation distance *d* in meters can be estimated using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts according to the transmitter manufacturer.
NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

WARRANTY POLICY

MONITORS

CAS Medical Systems, Inc. warrants the monitor, when new, to be free from defects in material and workmanship and to perform in accordance with manufacturer's specifications for a period of two (2) years from the date of original purchase from CAS or its authorized distributors or agents except as noted below.

The same warranty conditions are made for a period of one (1) year with respect to printer and battery and six (6) months on non-disposable accessories and certain components consisting of reusable SpO_2 sensors and other accessories provided by CAS as part of the original purchase. CAS warrants single-patient-use products for out-of-box failure only. Where the accessory is not a CAS manufactured product, the manufacturer's own warranty conditions apply.

CAS reserves the right to perform warranty service operations in its own factory, at an authorized repair facility, or at the customers' site.

Our obligation under this warranty is limited to repairing or, at our option, replacing any defective parts or our equipment, without charge, if such defects occur in normal service and with prompt notification.

Damage to any part through misuse, neglect, or accident, or by affixing any accessories or attachments other than CAS, Nellcor® and YSI manufactured accessories or attachments, is not covered by this warranty.

ACCESSORIES, BATTERIES AND CERTAIN COMPONENTS

In all cases, policy applies from date of purchase from CAS or its authorized distributors or agents.

Batteries:	(1) Year
Chargers:	(1) Year (not including power cord: see other accessories).
Lead Wires:	Out-of-box failure only.
Patient Cable:	(6) Months
SpO_2 Sensor:	(6) Months - Nellcor SpO_2 Sensor.
Temperature Probe:	(6) Months - YSI Temperature Probe.
Other Accessories:	Out-of-box failure only.
Certain Components:	(1) Year - Printer mechanism, but not including Thermal Print Heads.
Print Heads:	Out-of-box failure only.

THERE ARE NO WARRANTIES, WHICH EXTEND BEYOND THOSE EXPRESSLY DESCRIBED IN THIS AGREEMENT AND THE COMPANY MAKES NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

HOW TO CONTACT US

For Warranty Issues:		For Product Usage Information:
CAS Medical Systems, Inc. 44 East Industrial Road Branford, CT 06405 U.S.A. Phone: (800) 227-4414 (203) 488-6056 Fax: (203) 488-9438 E-Mail: custsrv@casmed.com Web: www.casmed.com		**Midmark** 10008 N. Dale Mabry Hwy, Suite 110 Tampa, FL 33618 U.S.A. Phone: Toll Free: 800-Midmark (643-6275) Fax: (813) 264-6218 E-Mail: www.Midmark.com/Pages/Contactus.aspx Web: www.Midmark.com

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1. INTRODUCTION AND INTENDED USE

INTRODUCTION

The Midmark Monitor is a multi parameter monitor measuring Heart Rate, Respiration, Oxygen Saturation, and Temperature. Heart Rate is measured by placing electrodes on either side of the chest that detect electrical changes produced by the heart. The same electrodes for heart rate detection are used to detect respiration through a process called impedance pneumography. The pulse oximeter function continuously monitors and displays values for functional arterial hemoglobin saturation and a pulse rate. Temperature is obtained using a temperature thermistor probe that can be applied to sites such as esophageal or rectal.

INDICATIONS FOR USE

The Midmark Monitor is a portable device intended to be used by trained clinicians for multi-parameter vital signs monitoring of veterinary patients. Parameters displayed are heart rate (BPM), respiration (BrPM), functional oxygen saturation of arterial hemoglobin (%SpO_2), pulse rate (PR) and temperature.

WARNING:
The Midmark Monitor is intended only as an adjunct in patient assessment. It must be used in conjunction with clinical signs and symptoms.

CONTRAINDICATIONS

- No contraindications are known at this time.

BRIEF DEVICE DESCRIPTION

The Midmark Monitor is compact, lightweight and portable, allowing it to be easily carried and used in a variety of clinical settings. The monitor is powered by AC Line Power or by a Nickel Metal Hydride (NiMH) rechargeable battery pack. The internal battery pack charges when the monitor is plugged into the AC wall outlet. The Midmark Monitor can be set to operate in one of nine (9) different languages: English, German, French, Italian, Spanish, Dutch, Swedish Portuguese or Norwegian. The monitor's display window can display various system alarm messages. These messages direct the user to check conditions such as the battery state and measurement problems.

The ECG parameter is intended for three-lead or five-lead ECG monitoring.

The Respiration (RESP) parameter is intended to measure changes in electrical impedance caused by chest shape changes associated with inspiration and expiration.

The Pulse Oximeter parameter (%SpO_2) determines arterial oxyhemoglobin saturation by measuring the absorption of red and infrared light passing through the tissue. Changes in absorption caused by pulsations of blood in the vascular bed are used to determine arterial saturation and pulse rate. The oximeter requires no routine calibration or maintenance. Oxygen saturation and pulse rate numeric values are available for display. When selected as a waveform parameter, a pulsatile waveform is also available for display. When selected on the display as a numeric parameter, on each detected pulse, a bar graph gives the user a pulse-by-pulse visual indication of waveform signal quality. An audio "beep" can be enabled that is generated each time the SpO_2 module detects a pulse.

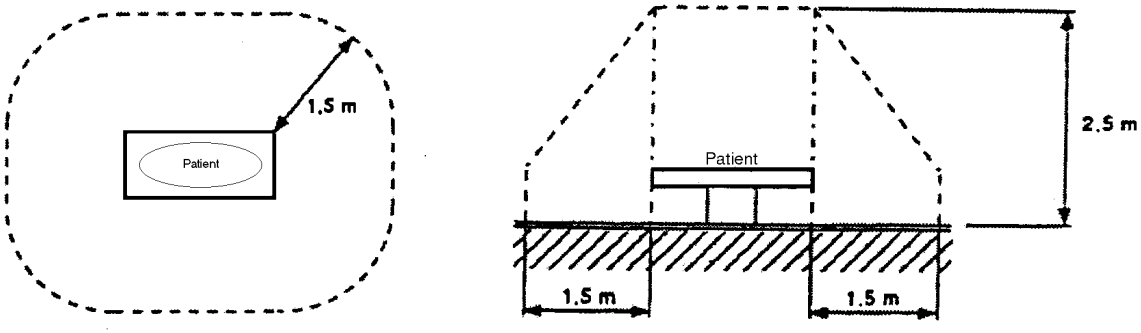
NOTE:
The bar graph is not proportional to the pulse volume.

The Temperature parameter (TEMP) is intended to measure temperature using an attachable probe. The temperature value displayed can be viewed in either Fahrenheit or Celsius.

PATIENT ENVIRONMENT

The Midmark Monitor has been tested with specific parts of the "system" used within the Patient Environment. Figure 1, defines the Patient Environment.

Figure 1: **Patient Environment**



The parts of the Midmark Monitor “system” that can be used in the Patient Environment are defined as;

Table 1: **Parts of the System**

The Midmark Monitor
Appropriate Accessories, listed in the ACCESSORIES section of this User’s Manual
Line Cord
Citizen CMP-10 Mobile Printer
RS232 Interconnect Cable (supplied with printer)
AC Adapter / Charger, Model TRC-09-1100-M from Group West or equivalent (supplied with printer)

DEFINITION OF TERMS

In this manual, “WARNING”, “CAUTION”, “IMPORTANT” and “NOTE” mean the following:

WARNING:

Directions that warn of conditions that put the patient or caregiver at risk.

CAUTION:

Directions that help you avoid damaging your monitor or losing data.

IMPORTANT:

Directions you should be particularly aware of; something not readily apparent.

NOTE:

Directions that make it easier to use your monitor.

2. UNPACKING THE MONITOR

INITIAL INSPECTION

Before unpacking the monitor, inspect the packaging for damage. If there are any signs of damage to the package, a claim should be filed immediately with the shipping agent. It is the receiver's responsibility to notify the carrier's local office to arrange for the pickup of the damaged items. Save the damaged shipping carton as evidence.

Contact CAS Medical Systems Inc. to report external damage and to arrange for repair or replacement of damaged equipment.

The shipping carton should contain the items listed below. Unpack the monitor and account for each item. Inspect each item for signs of external damage, dents, cracks, scratches, etc. If an item is missing or damaged, contact CAS Medical Systems Inc.

Record the monitor model, serial number and date of purchase at the back of this manual.

MONITOR CHECKLIST

Qty	Description
1	Monitor (9454 or 9456)
1	Hospital Grade AC Power Cord
1	3 or 5 - Lead ECG/Respiration Patient Cable (based on order)
1	3 or 5 - Lead Wire Set (based on order)
1	Nellcor®, Model # DOC-10 SpO_2 Interface Cable (for Model 9454)
1	Nellcor, VetSat® Veterinary SpO_2 Sensor and Clips (for Model 9454)
1	Electrode Gel, 1 Tube
1	Monitor User's Manual

NOTE:
The monitor is shipped with the appropriate line cord for the country and or voltage being used.

OPTIONAL ACCESSORIES

The Midmark Monitor is available with a rolling stand and basket, a soft-sided carrying case, and other optional accessories to fit your needs. Refer to Section 12, ACCESSORIES, for part number information.

Contact Midmark for more information.

3. SYMBOLS

Units may display the following symbols:

Alternating Current

CAUTION: Before using, read instructions included.

The CE Mark signifies the device has met all essential requirements of European Medical Device Directive 89/336EEC.

IPX1 Protection against ingress of water.

Indicates protection against the effects of the discharge of a cardiac defibrillator. Patient connections are Type CF, isolated for direct cardiac application, and protected against defibrillation.

Indicates protection against the effects of the discharge of a cardiac defibrillator. Patient connections are Type BF and protected against defibrillation.

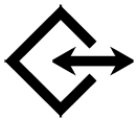
Equipotentiality Ground Post

ECG/RESP ECG/Respiration Input Connector

SYMBOLS (CONT.)

SpO_2 Pulse Oximeter Probe Input Connector

TEMP Temperature Probe Input Connector



Two way Communication Port
RS232 Interface Connector

These symbols appear on the front panel in the place of text.

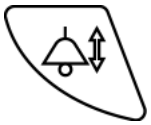
ON/STANDBY Pushbutton

SILENCE/RESET Pushbutton

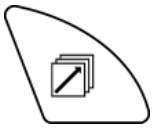
FREEZE/PRINT/MAIN Pushbutton

PARAMETER Pushbutton

SYMBOLS (CONT.)



ALARM LIMITS Pushbutton



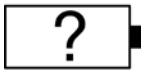
HISTORY Pushbutton

AUDIO/VISUAL Pushbutton

ARROW UP Pushbutton

ARROW DOWN Pushbutton

A Yellow LED visual indicator used along with the SILENCE/RESET pushbutton to display the status of the Audio Alarm Silence.

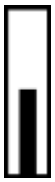


Horizontal bar graph display of the charge level of the battery

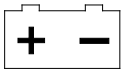
SYMBOLS (CONT.)

Heart Rate Icon
Flashes once for every detected heartbeat.

Respiration Breath Icon
Flashes once for every detected breath.



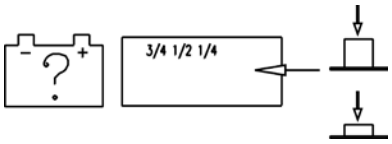
Vertical bar graph display of SpO_2 signal strength.



A tri-colored LED used to indicate the status of the monitors power source.

These symbols appear on the battery pack in place of text.

Recycling suggested (see General Notes).

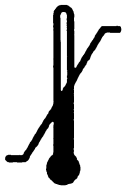


Located on the Smart Pack batteries, a set of four (4) LEDs used to indicate the approximate amount of charge remaining in the battery pack. See Page 67, CHECKING BATTERY STATUS for more information.

SYMBOLS (CONT.)

These symbols appear on the packaging in place of text.

Symbol used to indicate where Relative Humidity information concerning storage and transport can be located.



Symbol used to indicate the minimum and maximum storage and transport Temperatures.

This symbol appears on the printer in place of text.

WARNING: Before removing, read instructions in Section 9.

4. SAFETY MEASURES AND WARNINGS

WARNING:

The Midmark MODEL 9454 and 9456 monitors are intended for VETERINARY USE ONLY. Do not use on human patients.

The Midmark Monitor is defibrillator proof. It may remain attached to the patient during defibrillation, but the readings may be inaccurate during use and less than ten (10) seconds thereafter.

Do not use this instrument for any purpose other than specified in this manual. Doing so will invalidate the monitor's warranty.

Do not connect more than one (1) patient to the monitor.

Do not plug the monitor into an outlet controlled by a wall switch.

The position of subject, physiological condition, and other factors affect the readings.

Where the integrity of the external protective conductor in the installation or its arrangement is in doubt, EQUIPMENT shall be operated from its INTERNAL ELECTRICAL POWER SOURCE.

Isolation of product from mains can only be achieved by removal of external power cord.

Do not, under any circumstances, perform any testing or maintenance on the monitor or power cord while the unit is being used to monitor a patient. Unplug the power cord before cleaning or servicing the monitor. The operator should not perform any servicing except as specifically stated in this manual.

Do not touch part of non-medical electrical equipment in the patient environment after removal of covers, connectors etc… without the use of a tool which operate at voltages not exceeding 25 VAC or 60 VDC and the patient at the same time.

Do not use a frayed or damaged power cord, or any accessory if you notice any sign of damage. Contact Midmark for assistance.

Equipment not suitable for use in the presence of FLAMMABLE ANESTHETICS.

Equipment is not intended to be used in Oxygen Enriched Atmospheres.

Do not gas sterilize or autoclave the monitor.

Do not use the monitor in the presence of Magnetic Resonance Imaging (MRI) equipment.

Do not place liquids on top of the monitor. Do not immerse the monitor or power cord in water or any liquid. If unit is accidentally wetted it should be thoroughly dried. The rear cover can be removed by a qualified service technician to verify absence of water.

WARNING:

Accurate oxygen saturation measurement cannot be obtained with the Model 9454 when the oximeter is not measuring the pulse properly. If the SpO_2 waveform, perfusion bar graph or the Pulse Rate be erratic or inaccurate, first examine the animal for any signs of distress and only then re-examine sensor placement.

Inadequate perfusion, thick fur, dark skin or foreign matter that blocks light or an improperly applied sensor can result in erratic and inaccurate oxygen saturation and/or pulse rate measurement. Should the SpO_2 waveform or perfusion bar graph be at a low level, reposition the sensor or try a different sensor. If proper operation cannot be verified, remove the sensor from the animal and DO NOT use the oximeter on this animal.

In the event the sensor becomes dislodged from the animal, audible and visual alarms are activated requiring that a veterinary professional investigate the reason for the alarm status. The veterinary professional should investigate status and sensor attachment after every sensor alarm indication. It is possible when the sensor is dislodged from the animal (under certain conditions of light and vibration of the sensor) for the pulse oximeter to display normal physiological values.

ACCURACY – If the accuracy of any measurement does not seem reasonable, first check the patient's vital signs by alternate means and then check the Midmark Monitor for proper functioning.

APPLICATION – This monitor is not designed for direct cardiac connection.

CABLES – Route all cables away from patient's neck to avoid possible strangulation.

CONDUCTIVE CONNECTIONS – Avoid making any conductive connections to applied parts (patient connection), which is likely to degrade safety.

CONDUCTIVE PARTS – Ensure that the conductive parts of the lead electrodes and associated connectors do not contact other conductive parts including earth.

CONNECTIONS – The correct way to connect a patient to the monitor is plug the electrode leads into the patient cable which in turn connects to the monitor. The monitor is connected to the wall socket by the power cord. Do not plug the electrode leads into the power cord, a wall socket, or an extension cord.

DEFIBRILLATION – Do not come in contact with patients during defibrillation. Serious injury or death could result.

DISPOSAL – Dispose of the packaging material, observing the applicable waste control regulations.

SITE REQUIREMENTS – For safety reasons, all connectors for patient cables and sensor leads are designed to prevent inadvertent disconnection, should someone pull on them. Do not route cables in a way that they may present a stumbling hazard. For devices installed above the patient, adequate precautions must be taken to prevent them from dropping on the patient.

CAUTION:

Before each use, make sure that the monitor default alarm settings are appropriate for the specific patient being monitored.

Pressing the front panel keyswitch with a sharp or pointed instrument may permanently damage the keyswitch. Press the keyswitch using only your finger.

Even though the ECG patient circuit is electrically isolated, it has not been designed for direct application on a patient's heart.

A calibration check is recommended once every year.

Inspect the monitor and sensors for any damage prior to operation. If any damage is noted, the monitor should not be used until it has been serviced. The monitor should be repaired only by personnel authorized to do so by CAS Medical Systems, Inc.

Use only CAS Medical Systems approved accessories and sensors to preserve the integrity, accuracy and the electromagnetic compatibility of the monitor.

The oximeter is factory calibrated to determine the percentage of arterial oxygen saturation of functional hemoglobin. Significant levels of dysfunctional hemoglobins such as carboxyhemoglobin or methemoglobin may affect the accuracy of the measurement.

Cardiogreen and other intravascular dyes, depending on the concentration, may affect the accuracy of the oximeter measurement.

Some sensors may not be appropriate for a particular patient. If at least ten seconds of one bar pulses cannot be observed for a given sensor, change sensor location or sensor type until this condition is achieved.

If the monitor fails to respond, do not use it until the situation has been corrected by qualified personnel.

ACCIDENTAL SPILLS – In the event that fluids are accidentally spilled on the monitor, take the monitor out of operation and inspect for damage.

BATTERY POWER – If the monitor will not be used or not connected to AC line power for a period over six (6) months, remove the battery.

ELECTRICAL SHOCK – To reduce the risk of electrical shock, do not remove the back cover. Refer all servicing to qualified personnel.

ELECTROCAUTERY PRECAUTIONS – To prevent unwanted skin burns, apply electrocautery electrodes as far as possible from all other electrodes, a distance of at least 15 cm/6 in. is recommended.

ELECTROMAGNETIC COMPATIBILITY (EMC) – The equipment needs special precautions regarding EMC. Be aware that strong electromagnetic fields may interfere with monitor operation. Interference prevents the clear reception of signals by the monitor. If the hospital is close to a strong transmitter such as TV, AM, or FM radio, police or fire stations, a HAM radio operator, an airport, or cellular phone, their signals could be picked up as signals by the monitor.

CAUTION:

ELECTROSURGERY – Measurements may be affected in the presence of strong electromagnetic sources such as electro surgery equipment.

GROUNDING – Do not defeat the three-wire grounding feature of the power cord by means of adaptors, plug modifications, or other methods. Do not use extension cords of any type. Do not connect the monitor to an electrical outlet controlled by a wall switch or dimmer.

INTERFACING OTHER EQUIPMENT – Monitoring equipment must be interfaced with other types of medical equipment by qualified biomedical engineering personnel. Be certain to consult manufacturers' specifications to maintain safe operation.

LEAKAGE CURRENT TEST – The interconnection of auxiliary equipment with this device may increase the total leakage current. When interfacing with other equipment, a test for leakage current must be performed by a qualified biomedical engineering personnel before using with patients. Serious injury or death could result if the leakage current exceeds applicable standards. The use of accessory equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include: use of the accessory in the patient vicinity; and evidence that the safety certification of the accessory has been performed in accordance with the appropriate IEC 601.1 and/or IEC 601.1.1 harmonized national standard.

STACKING – Where monitor is used adjacent to or stacked with other equipment, the monitor should be observed to verify normal operation in the configuration in which it will be used.

GENERAL NOTES:

There are no known risks with common disposal of equipment or accessories; however, the disposing of accessories should follow in accordance with local hospital policies. The user should ensure these policies do not conflict with any local, state or federal guidelines.

The monitor is suitable for use in the presence of electro surgery.

The monitor is suitable to be connected to public AC mains power.

The Midmark Monitor is not "Category AP or APG Equipment".

The Midmark Monitor is for "Continuous Operation".

The Midmark Monitor with ECG/Respiration applied parts is "Type CF Defibrillation Proof".

The Midmark Monitor applied parts are "Type BF Defibrillation Proof".

The Midmark Monitor provides "DRIP-PROOF" level of protection from ingress to moisture. Do not expose the Midmark Monitor to extreme moisture levels such as direct exposure to rain. Exposure to extreme moisture levels may cause incorrect or inaccurate performance, or device failure during or after exposure.

AUTOMATIC SAFETY FEATURES

The monitor has been designed for patient safety.

All equipment parts are protected against the effects of the discharge of a defibrillator. No separate actions are required when using this equipment with a defibrillator.

Should the AC wall power be interrupted coming into the monitor, the monitor automatically runs off battery power. An indication of this would be a change in color of the Battery Charge LED from Green to either Orange or Red.

Whenever the power is disconnected from the monitor and the monitor is not allowed to shut down in an orderly fashion, the monitor, when re-powered alerts the user. Refer to Page 69, POWER FAIL for more information.

CAUTION:
Regardless of these safety features, always be sure to check that there are no signs of prolonged impairment of patient circulation and that the monitor is functioning properly.

5. ECG AND RESPIRATION MONITORING

ECG MONITORING

The Midmark Monitor records heart rate with electrode clips attached to the patient. Electrodes detect signals caused by changes of electrical conduction in the heart during the cardiac cycle. Heart rate is computed on a beat-to-beat basis using the R-R interval of the QRS complex.

CAUTION:
Even though the ECG patient circuit is electrically isolated, it has not been designed for direct application on a patient's heart.

POSITIONING ANESTHETIZED PATIENTS

For ECG monitoring during anesthesia, it is most important to position patients on the table for the procedure. If standard lead placement as described below is not possible, leads should be attached to the body where they will be least subject to movement and away from the surgical site. It is preferable to view an upright QRS complex for monitoring ECG. A heart base to apex lead arrangement will be best if the negative lead is placed at the base (point of right shoulder at thoracic inlet) and the positive lead at the apex (low on caudal left thorax). Standard right forelimb lead is negative and standard left hind leg is positive in lead two; so if these leads are properly placed and the machine is set to Lead II, an upright complex should be the result.

POSITIONING CONSCIOUS PATIENTS

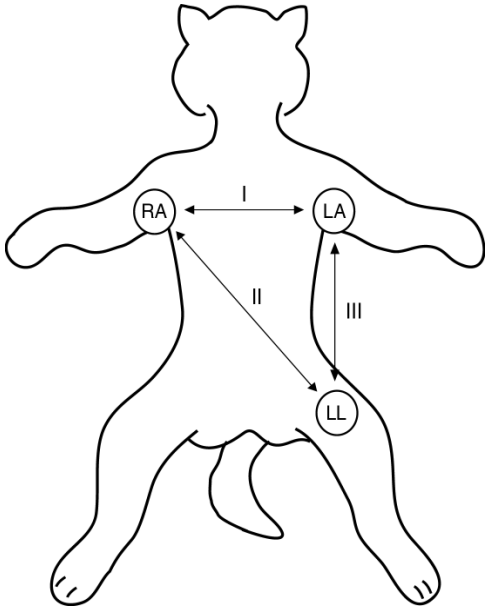
Standard position for recording diagnostic ECG in dogs is right lateral recumbency. Diagnostic tracings can be obtained in cats in either right lateral or sternal position. Limbs should be perpendicular to the spine and parallel with their opposite member. In awake cats and dogs, it is best to have the patient held by a veterinary technician or veterinary assistant. One lead should be applied first to determine comfort level and adjustment made as needed. Then the other clamps can be placed in position. It is important that the patient be kept still. A moving patient may cause clips to saw into skin tissue leading to discomfort and change in position of electrodes.

LEAD ATTACHMENT

3-Lead

Leads should be attached just below the elbow on the front leg and just above the stifle on the hind leg. The following lead sequence should be applied for a 3 lead system: Right Foreleg **(RA-white)**; Left Foreleg **(LA-black)**; Left Hind Leg **(LL-red)**. Refer to Figure 2 and Table 2 for more information.

Figure 2: **3-Lead Placement**



NOTE:
In order to pick up ECG and Respiration signals, the leads must not be placed on the animal's legs, but on the left and right chest areas.

Table 2: **3-Lead Color and Coding**

USA Standard	International Standard
LA = black (Left Foreleg)	L = yellow (Left Foreleg)
RA = white (Right Foreleg)	R = red (Right Foreleg)
LL = red (Left Hind Leg)	F = green (Left Hind Leg)

5-Lead

For a 5 lead system, four limb leads can be applied (**RA, LA, RL, and LL)** with the exploring lead (**brown**) used for diagnostic purposes as needed. Otherwise, the exploring lead may be left unplugged. Refer to Figure 3 and Table 3 for more information.

NOTE:
Do not use the 5-Lead Patient Cable for 3-Lead monitoring. A "Leads OFF" message will be displayed. Refer to Section 12, ACCESSORIES for the 3-Lead Patient Cable part number information.

Figure 3: **5-Lead Placement**

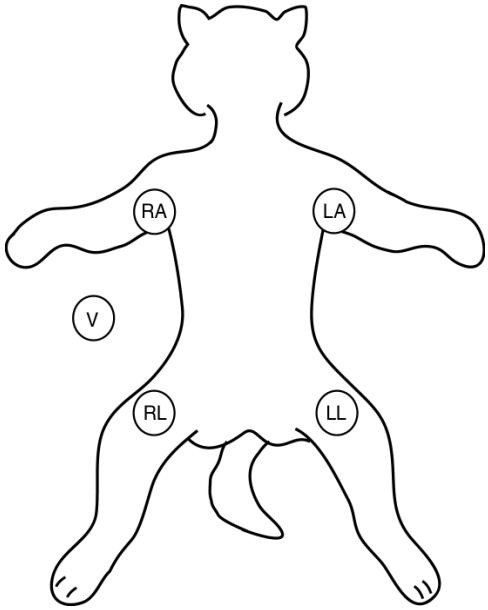


Table 3: **5-Lead Color and Coding**

USA Standard	International Standard
LA = black (Left Foreleg)	L = yellow (Left Foreleg)
RA = white (Right Foreleg)	R = red (Right Foreleg)
RL = green (Right Hind Leg)	N = black (Right Hind Leg)
LL = red (Left Hind Leg)	F = green (Left Hind Leg)
V = brown (explore)	C = white (common)

LEAD CONTACT

Sites where leads are attached to the body must be properly prepared to optimize contact. Dogs and cats have enough electrolyte material on their skin and hair so that merely moistening lead sites with 70% isopropyl alcohol is appropriate. This will usually be sufficient for ECG recording/monitoring for a short time, 30 to 60 minutes, depending upon the relative humidity. For monitoring during longer periods, an electrode paste should be used. It is best to first wet the hair at the lead attachment site with alcohol; then place paste on the moistened hair and skin. It is important that the paste be in direct contact with skin. For patients with dense undercoat, rub paste with fingers to assure that it has made contact with skin. Crocodile clips are supplied with this monitor and they must open wide enough to firmly but gently grasp the skin.

RECORDING

1) Once the electrode clips are in place and the leadwires attached, patient cables and leadwires must be kept away from the neck area to minimize entanglement and accidental strangulation.

2) Connect the leadwires to the ECG patient cable, matching the colored end of the leadwire to the corresponding color on the cable.

3) Connect the round end of the ECG patient cable to the ECG/RESP connector on the side panel of the monitor.

4) Press the ON/STANDBY pushbutton to turn “ON” the monitor.

5) Check that the monitor is accurately detecting the heartbeat and respiration by watching the monitor to see that the heart and lung visual indicators flash with each heartbeat and breath. When the values have been determined, they will be displayed on the front panel respective as heart rate (HR) and respiration rate (RR).

6) If the heart and lung visual indicators do not correspond to the patient’s heart rate and/or respiration, reposition the electrode clips until the indicators flash in synch with the patient’s heartbeat and breathing. This will help to minimize false alarms.

NOTE:
Respiration monitoring, by default, is set to “OFF”. Should Respiration monitoring be required, the feature can be turned “ON”. Refer to Page 49, PARAMETERS MENU for the menu selection.

7) If required, refer to Page 49, PARAMETERS MENU and configure the appropriate waveform (s) to be viewed and printed.

8) Check the alarm limits and configure them appropriately for the patient. Refer to Page 61, ALARM LIMIT VALUES.

FREEZE TRACES

While viewing the Main display screen the user can select to freeze the traces. Depress the FREEZE/PRINT/MAIN pushbutton. The message “Traces Frozen” appears at the top of the Main Display screen. While frozen, the numerics continue to update.

Depress again to un-freeze. Traces will remain frozen for sixty (60) seconds if no pushbutton is depressed or if the user enters one of the menu selections.

RESPIRATION MONITORING

NOTE:
The Respiration parameter in the Midmark monitor, by default, is set to OFF. Should Respiration monitoring be required, the feature can be turned "ON". Refer to Page 49, PARAMETERS MENU for the menu selection.

The Midmark Monitor determines respiration by impedance pneumography. Patient respiration is achieved by applying a low voltage, high frequency AC signal across the active left and right chest ECG leads (LA and RA). The monitor detects changes in thoracic impedance that occur as a result in chest movements. Impedance normally increases with inspiration and decreases with expiration.

Electrode placement is crucial to monitoring respiration by the impedance method. The sensitivity of the monitor and its ability to accurately detect respiration is greatly enhanced or impeded by the quality of the electrodes and electrode placement.

The following is a general procedure for respiratory monitoring:

1) Check the skin area where the electrodes are to be placed.
2) Observe the patient to determine where the greatest breathing movement occurs on the chest.
3) The leadwires that attach to the electrode clips are color coded for ease of identification. Refer to Table 2 for the lead color based on the lead set being used.
4) The third or ground electrode clip (LL) is placed on the thigh of either rear leg. The ground is a reference electrode allowing for better signal detection.
5) Once the electrode clips are in place and the leadwires attached, patient cables and leadwires must be kept away from the neck area to minimize entanglement and accidental strangulation.
6) Connect the leadwires to the ECG patient cable, matching the colored end of the leadwire to the corresponding dot on the cable.
7) Connect the round end of the ECG patient cable to the ECG/RESP connector on the side panel of the monitor.
8) Press the ON/STANDBY pushbutton to turn "ON" the monitor.
9) Check that the monitor is accurately detecting the heartbeat and respiration by watching the monitor to see that the heart and lung visual indicators flash with each heartbeat and breath.
10) If the heart and lung visual indicators do not correspond to the patient's heart rate and/or respiration, reposition the electrodes until the indicators flash in synch with the patient's heartbeat and breathing. This will help to minimize false alarms.

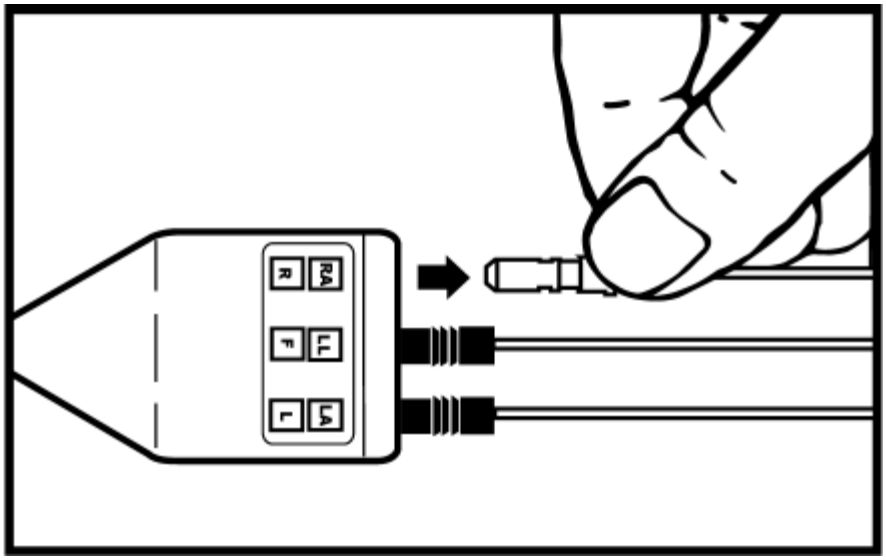
11) If required, refer to Page 49, PARAMETERS MENU and configure the appropriate waveform (s) to be viewed and printed.

12) Check the alarm limits and configure them appropriately for the patient. Refer to Page 61, ALARM LIMIT VALUES.

DETACHING THE LEADWIRES

To remove leadwires from a patient cable, always grasp the strain relief plastic portion of the leadwire. Do not pull the wire itself.

Figure 4: **Detaching the Leadwires**



REMOVING THE PATIENT CABLE

To remove the patient cable from the monitor's ECG/RESP connector, press and hold down on the release button to unlock the cable and pull straight back. Do not pull on the cable itself.

Refer to Section 12, ACCESSORIES for electrode clips and patient cable types and part number information.

6. PULSE OXIMETRY MONITORING

(Model 9454)

The Midmark Model 9454 Monitor is intended for animal monitoring by trained personnel. It displays numerical values for oxygen saturation and pulse rate. The Model 9454 has provisions for alarm settings.

WARNING:

Use only Nellcor® VetSat® veterinary oxygen transducer (sensor and clips). Use of other oxygen transducers may cause improper oximeter performance. Monitors equipped with Nellcor oximetry will have the Nellcor OxiMax® logo next to the SpO_2 connector. For more information, refer to the Directions for Use pamphlet included with each Nellcor VetSat sensor.

INSTRUCTIONS FOR USE

NOTE:

Reusable sensors may be used on the same site for a maximum of four (4) hours, provided the site is inspected routinely to ensure skin integrity and correct positioning. Because individual skin condition affects the ability of the skin to tolerate sensor placement, it may be necessary to change the sensor site more frequently with some patients.

1) Select a sensor and clip that is appropriate for the patient. There are two (2) sizes of VetSat veterinary sensor clips: model VSC-S (small), and model VSC-L (large).
2) Clean the VetSat sensor and sensor clip separately before and after each use. Refer to Page 85, CLEANING for more information.
3) Open the clip by pressing with the thumb and forefinger.
4) Slide one of the sensor's alignment buttons along the clip slot until the sensor pad is fully engaged in the clip.
5) Slide the second sensor button along the other clip slot until the second sensor pad is fully engaged in its side of the clip.

NOTE:

Check that the VetSat optical sensor pads are facing each other directly.

6) The sensor is now ready to be applied to the patient. The preferred sensor application site for canine, feline and equine animals is on the tongue, with the sensor's optical components positioned on the center of the tongue. Alternatively, the sensor and clip may be applied to the animal's lip, toe, ear, prepuce, or vulva.

NOTE:

If the sensor does not track the pulse reliably, it may be incorrectly positioned-or the sensor site may be too thick, thin, or deeply pigmented to permit appropriate light transmission. If any of these situations occurs, reposition the sensor or try another sensor site. If the sensor site is one that is covered with fur, try shaving the site and reapplying the sensor.

7) Be sure that the sensor cable is positioned along the side of the animal's face and body to avoid entanglement with the animal.

WARNING:
Do not use supplemental tape to adhere the clip and sensor directly to the site; this can restrict blood flow and cause inaccurate measurements. For best results, secure the sensor cable independently from the sensor.

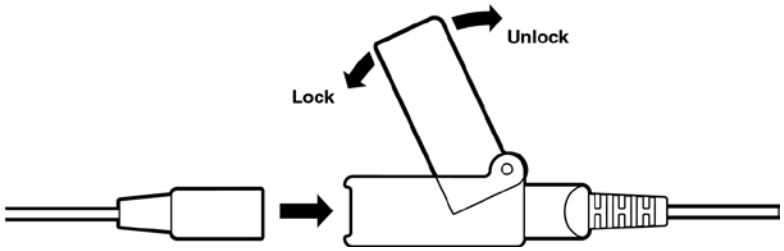
8) Connect the sensor assembly to the Interface Cable:

   a) Place the plastic hinged cover in the unlocked position (perpendicular to the connector).

   b) Connect the sensor assembly to the Interface Cable.

   c) Lock the plastic hinged cover to prevent accidental cable disconnection.

Figure 5: **Sensor to Interface Cable**



9) Plug the Interface Cable into the SpO_2 connector on the side panel of the monitor. The connector is shaped like a "D". Line up the "D" on the Interface Cable with the "D" on the receptacle. Push the cable in until you hear an audible "click".

10) Press the ON/STANDBY pushbutton to turn "ON" the monitor.

11) Verify that the sensor is properly positioned by observing at least ten seconds of a continuous pleth waveform being displayed across the screen. When a valid signal is detected, the monitor displays the $\%SpO_2$ and Pulse Rate values. Should the perfusion light be at a low level, reposition the sensor or try a different sensor. If normal operation cannot be achieved, call a Midmark representative for assistance.

12) If required, refer to Page 49, PARAMETERS MENU and configure the appropriate waveform (s) to be viewed and printed.

13) Check the Alarm Limits and configure them appropriately for the patient. Refer to Page 61, ALARM LIMIT VALUES for more information.

14) If an audio "beep" is required based on the $\%SpO_2$, configure the Beep Source to $\%SpO_2$ in the Audio/Visual menu and adjust the Beep Volume to the desired level. Refer to Page 51, AUDIO/VISUAL MENU for more information.

SatSeconds™ ALARM MANAGEMENT

False or nuisance alarms are a common concern with pulse oximetry monitoring. Nuisance alarms are often triggered by minor and brief desaturation events that are clinically insignificant. Clinicians tend to manage these alarms by ignoring them, turning off the alarm or monitor, or widening the alarm limits. The Midmark Monitor incorporates Nellcor's SatSeconds Alarm Management feature that offers a better way to manage nuisance alarms without sacrificing patient safety.

The SatSeconds function can be activated from the Alarm Limits menu by selecting a SatSeconds limit, or "clock" of 10, 25, 50, 100 or OFF SatSeconds. Clinicians who choose to employ the SatSeconds function should select a limit suited to their clinical environment and patient conditions. Think of SatSeconds as the product of magnitude and time a patient exceeds SpO_2 alarm limits. For example, 3 points below the alarm limit for 10 seconds equals 30 SatSeconds. An alarm is only triggered if a desaturation event occurs that reaches the SatSeconds limit you selected. As a safety net, when three or more SpO_2 alarm violations occur within 60 seconds, an alarm will sound even if the SatSeconds limit has not been reached.

NOTE:
When SatSeconds is set to OFF, the monitor will immediately alarm for %SpO_2 limit violations based on the selection made in the Alarm Limits menu.

SENSOR REMOVAL

CAUTION:
For the comfort of the patient and to avoid damaging the sensor, do not pull on the cable when removing the sensor and clip from the sensor site.

When SpO_2 monitoring is completed, remove the sensor from the patient.

To remove the sensor and clip from the patient, press the clip open and remove.

When the probe is removed from the patient, the message "SpO_2 Probe OFF" is displayed, the Equipment Alarm LEDs are flashing and an audible alarm sounds, indicating a connection has been lost.

To acknowledge the alarm, depress the SILENCE/RESET pushbutton.

The monitor silences the audible and visual alarms and the message "SpO_2 Probe OFF" remains on the display.

To remove the sensor from the clip, grasp the end of each sensor pad and pull it through to the inside of the clip. The sensor should pop out of the clip easily. DO NOT pull on the cable.

NOTE:
If either the 2-Minute Audio Silence or Permanent Audio Silence is enabled, no audio will be heard but a visual message will appear in the Message Window.

REMOVING THE INTERFACE CABLE

When SpO_2 monitoring is not required, disconnect the Interface Cable by squeezing the grey tabs with your thumb and index finger while pulling the connector away from the monitor.

NOTE:
To avoid damage to the Interface Cable, always hold it by the connector rather than the cable when connecting or disconnecting either end. To obtain longer life, avoid excessive kinking or coiling the sensor cable.

When the probe is disconnected from the monitor, the message "No SpO_2 Probe" is displayed, the Equipment Alarm LEDs are flashing and an audible alarm sounds, indicating a connection has been broken.

To acknowledge the alarm, depress the SILENCE/RESET pushbutton.

The monitor silences the audible and visual alarms and the message "No SpO_2 Probe" is removed from the display.

NOTE:
If either the 2-Minute Audio Silence or Permanent Audio Silence is enabled, no audio will be heard but a visual message will appear in the Message Window.

See Section 12, ACCESSORIES for Nellcor oximeter probe types and part number information.

PERFORMANCE CONSIDERATIONS

If there is excessive ambient light, cover the sensor site with opaque material. Failure to do so may result in inaccurate measurements. Light sources that can affect performance include surgical lights (especially those with a xeon light source), bilirubin lamps, fluorescent lights, infrared heating lamps and direct sunlight.

7. TEMPERATURE MONITORING

YELLOW SPRINGS INTERNATIONAL (YSI) TECHNOLOGY

The Midmark Monitor is designed to measure temperature to aid in the assessment of thermoregulation.

NOTE:
For temperature monitoring a YSI temperature probe and Adapter are required.

To take a Temperature measurement;

1) Consult proper procedure for application of the probe to the patient.
2) Connect the probe to the Temperature Adapter. Connect the Adapter to the TEMP connector on the side panel of the monitor.
3) Press the ON/STANDBY pushbutton to turn “ON” the monitor.
4) Check that the monitor is accurately measuring temperature. When the value has been determined, it will be displayed on the front panel as (^{o}F or ^{o}C).
5) Configure the appropriate temperature scale (^{o}F or ^{o}C). Refer to Page 48, SELECTING THE TEMPERATURE UNITS.

NOTE:
When the Temperature value being measured is greater than 43 ^{o}C (109.4 ^{o}F), the TEMP numeric value will be displayed as “>>>>>” indicating a value above the monitors temperature range.

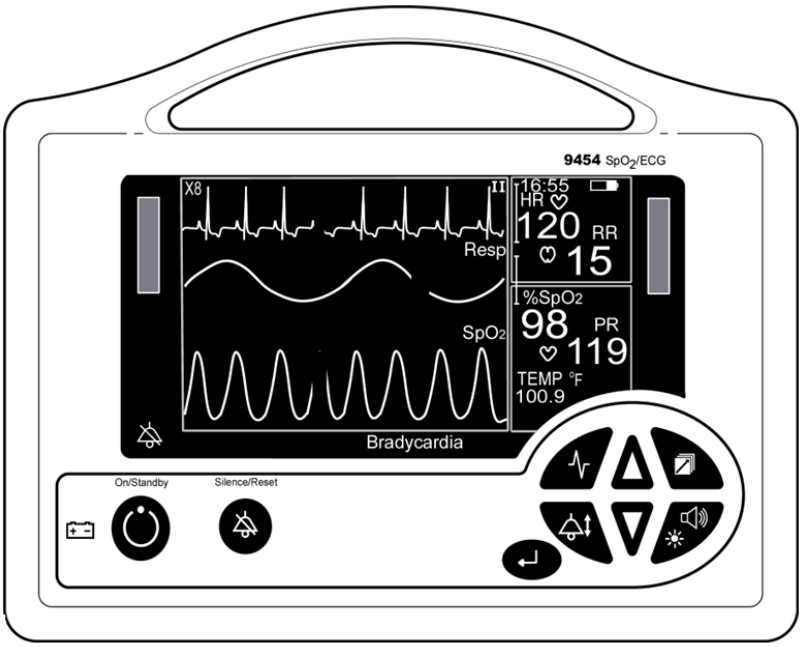
NOTE:
When no Temperature probe is connected, the TEMP numeric display will be blank.

Refer to Section 12, ACCESSORIES for Temperature probe types and part number information. Consult instructions enclosed with the sensor for proper application.

8. MONITOR OPERATION

FRONT PANEL

Figure 6: **Front Panel View**

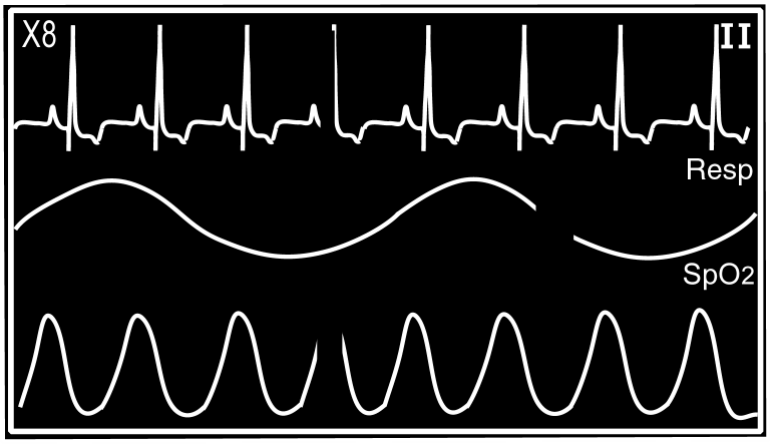


DISPLAY AREAS

The Main display area of the Midmark Monitor can be broken down into five (5) sections of information. They are:

MAIN DISPLAY AREA

Figure 7: **Main Display Area**



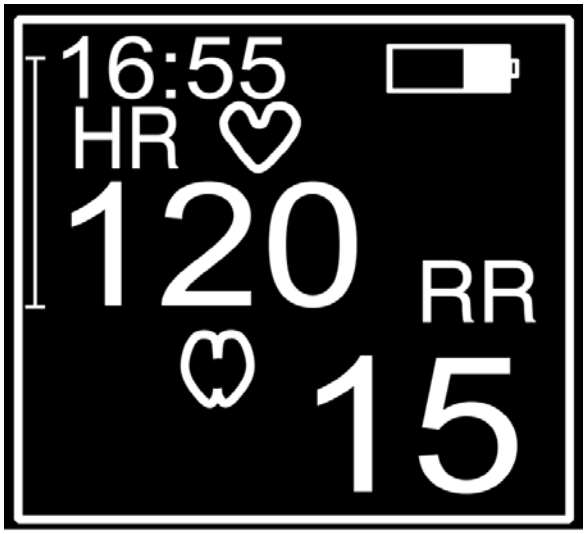
During normal operation, this section (Refer to Figure 7 on the previous page) displays the traces that have been selected in the Parameters menu. Up to three (3) traces can be selected. The names of the traces are also displayed to better identify them. The traces are displayed in an erase bar format.

The Midmark Monitor automatically selects as Trace #1 an ECG waveform trace. Included with the ECG trace is the ECG Gain selection.

This section is also used to display, when selected, the Audio/Visual, History, Limits, Parameters, Service and Setup menus.

TIME, BATTERY AND NUMERIC STATUS

Figure 8: **Time, Battery and Numeric Status**

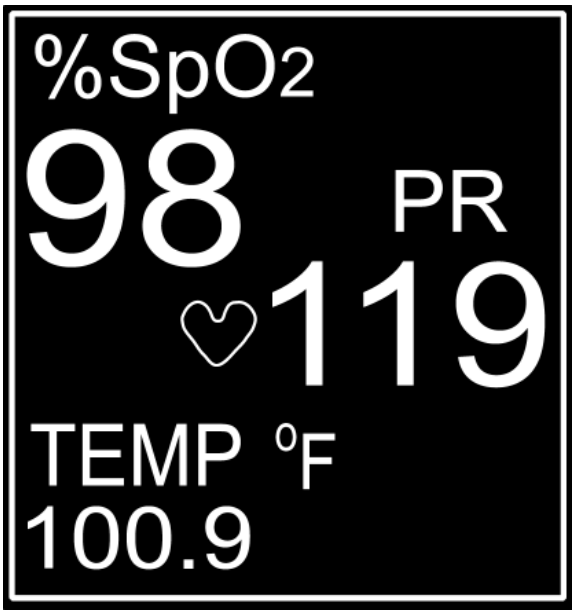


This section contains the current monitor time and Battery Charge Status icon. This section also contains numeric values and flashing visual icons for both Heart Rate and Respiration Rate. Also displayed are size markers for both the ECG and Respiration waveforms. The size marker for ECG represents a QRS of 1mV, and the size marker for Respiration represents a breath of 1 Ohm.

NOTE:
When Respiration is turned OFF, the RR name, numeric and lung icon will be blank.

NUMERIC AND TEMPERATURE

Figure 9: **Numerics and Temperature**



This section displays the numeric information for $\%SpO_2$ and Pulse Rate as well as the Temperature value.

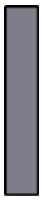
PATIENT ALARM MESSAGE WINDOW

The text section directly below the bottom trace and to the right, in Figure 6, displays any patient related alarm messages: example Bradycardia, Tachycardia.

EQUIPMENT MESSAGE WINDOW

The text section directly below the bottom trace and to the left, in Figure 6, displays the current status of the Audio Alarm Silence (2 Minute or Permanent) as well as other Equipment type alarm messages.

DISPLAY VISUAL INDICATORS



Two (2) light bar visual indicators. One on the left side of the monitor and one on the right side of the monitor are used for alarm indications.

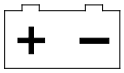
The Yellow light bar, on the left side, is lit indicating an equipment alarm.

The Red light bar, on the right side, is lit to indicate a patient alarm.

A Yellow LED visual indicator used along with the SILENCE/RESET pushbutton to display the status of the Audio Alarm Silence feature. Refer to Page 65 for more information.

The status of the LED is:

- "ON" continuously = 2 Minute Audio Disable
- Flash one second "ON"/one second "OFF" = Permanent Audio Disable



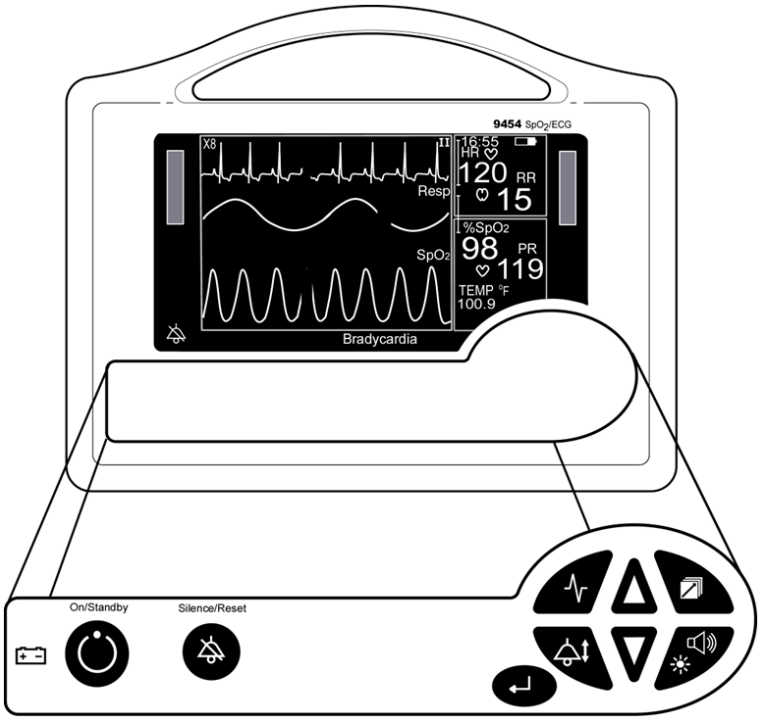
A tri-colored LED visual indicator used to display the status of the power source and battery condition.

The status of the LED is:

- GREEN = Monitor is connected to an AC power source
- ORANGE = In Use on Battery
- RED = Battery Low or Dead Battery

FRONT PANEL CONTROLS

Figure 10: **Front Panel Controls**



ON/STANDBY:

Turns “ON” the monitor’s display.

SILENCE/RESET:

When depressed during an active patient alarm, silences the audio portion of that alarm for fifteen (15) seconds.

When depressed during an active equipment alarm, the alarm condition shall be acknowledged along with the audio and visual shall be removed.

Used to enable and disable the 2 Minute or Permanent Audio Alarm Silence feature. Refer to Page 44, AUDIO ALARM SILENCE (SILENCE/RESET Pushbutton) for more information.

FREEZE/PRINT/MAIN:

FREEZE:

When depressed while viewing the Main display screen will freeze the traces. The message “Traces Frozen” appears at the top of the Main Display screen. While frozen, the numerics continue to update. Depress again to un-freeze. Traces will remain frozen for sixty (60) seconds if no pushbutton is depressed or if the user enters one of the menu selections.

PRINT:

Depress and hold for two (2) seconds to print Waveforms, History or Alarm History information.

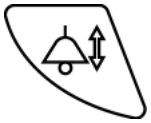
MAIN:

When depressed while in a sub menu, returns to the Main display screen.

PARAMETERS:

Allows the user to setup and configure how the Parameters being monitored are viewed on the display.

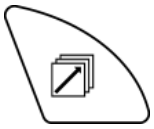
Refer to Page, 49, PARAMETERS MENU for more information.



ALARM LIMITS:

Allows the user to enter, set, save and restore the monitor’s Alarm Limits.

Refer to Page 58, PATIENT ALARMS for more information.



HISTORY:

Allows the user to review stored patient readings.

Refer to Page, 52, HISTORY for more information.

AUDIO/VISUAL:

Allows the user to setup and configure the Audio and Visual parameters being monitored.

Refer to Page, 51, AUDIO/VISUAL MENU for more information.

ARROW UP:

Allows forward Adjustment (History, Limits and Monitor Setup Menus).

Depress to cycle through menu selections or depress and hold for quicker advance.

ARROW DOWN:

Allows backwards Adjustment (History, Limits and Monitor Setup Menus).

Depress to cycle through menu selections or depress and hold for quicker advance.

NEXT

The **HISTORY** and **AUDIO/VISUAL** pushbutton keys have been programmed to allow the user to advance horizontally to the ***next*** parameter selection in the menus.

PREVIOUS

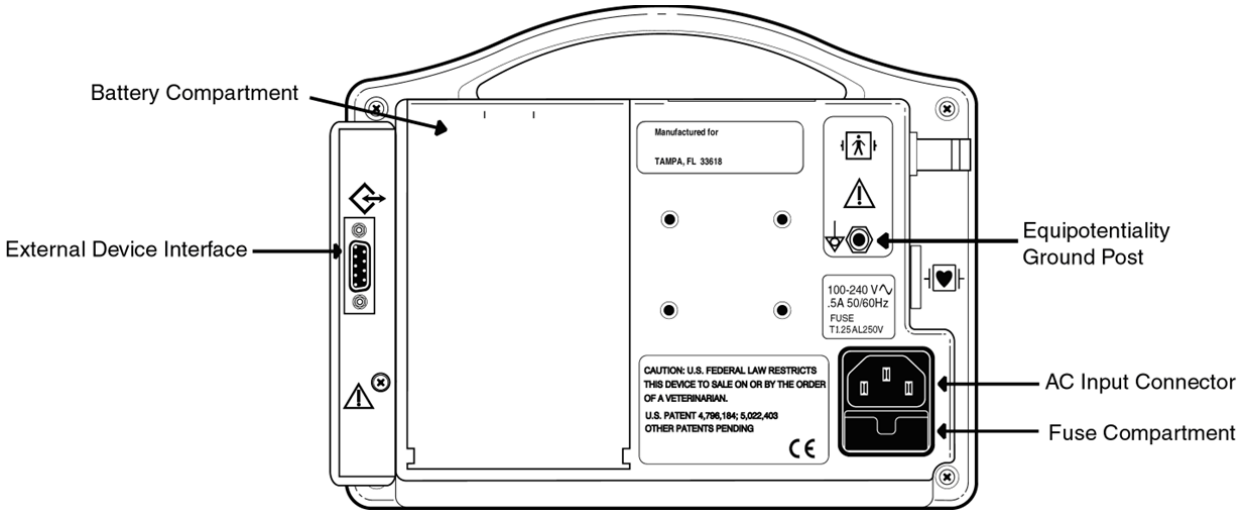
The **PARAMETERS** and **ALARM LIMITS** pushbutton keys have been programmed to allow the user to advance horizontally backwards to the ***previous*** parameter selection in the menus.

INFRARED (Ir) DATA PORT

An Infrared (Ir) output port, located on the bottom panel of the monitor's front cover, is available to print Waveforms, History and Alarm data to the optional external printer or other data collection device(s). Maximum distance is approximately three (3) Feet, direct line of sight operation.

REAR PANEL

Figure 11: **Rear Panel View**



AC LINE POWER CONNECTOR

Receptacle for the AC power cord.

FUSE COMPARTMENT

The power input receptacle incorporates dual fuses located in the hot and neutral lines.

BATTERY COMPARTMENT

The Midmark Monitor is equipped with a 7.2 Volt, 3700 mAhr battery pack, when fully charged, is capable of running the monitor for approximately four (4) hours.

NOTE:
Based on a Model 9454 monitor.

EQUIPOTENTIALITY GROUND POST

This terminal can be used to provide an auxiliary ground for the monitor.

EXTERNAL DEVICE INTERFACING

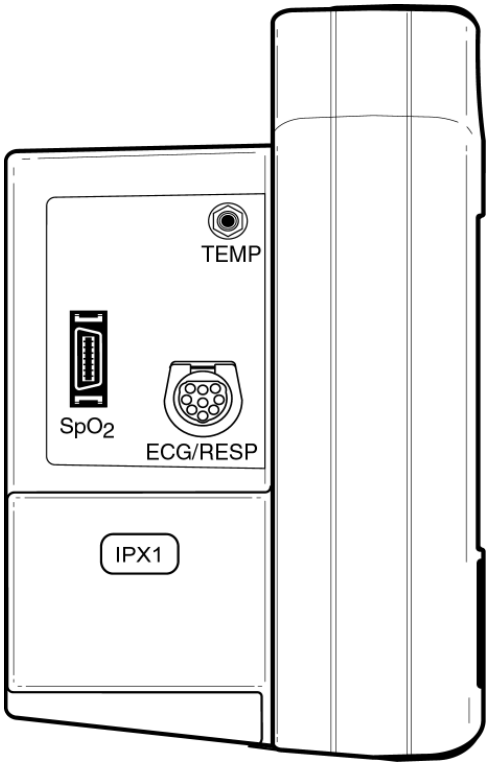
The Midmark Monitor comes equipped with a DB9 RS232 serial output connector that is used to interface to the Citizen CMP-10 Mobile Printer or another serial printing device.

Refer to Section 9, EXTERNAL PRINTER for more information.

NOTE:
The serial number label is located on the bottom of the monitor.

LEFT SIDE VIEW

Figure 12: **Left Side Panel View**



ECG/RESP CONNECTOR

The ECG/RESP connector is mechanically keyed to accept only CAS Medical Systems' 3-Lead or 5-Lead patient cable. Connect either the 3-Lead or 5-Lead Patient Cable in this receptacle for ECG and Respiration monitoring.

NELLCOR® VET SpO_2 SENSOR CONNECTOR

(Model 9454)

The SpO_2 connector is compatible only with Nellcor® VetSat® veterinary sensor. Connect the Interface Sensor cable in this receptacle for SpO_2 monitoring.

TEMP CONNECTOR

Connect the adapter and sensor cable in this receptacle for Temperature monitoring.

MONITOR OPERATING INSTRUCTIONS

TURNING THE Midmark MONITOR "ON"

Press the ON/STANDBY pushbutton on the front panel to turn the monitor "ON".

Each time the monitor is turned "ON", a three (3) second electronic Power On Self-Test (POST) is conducted to ensure that its internal circuits are functioning properly.

NOTE:
The user should use the Power On Self Test as a verification tool that all front panel visual indicators and the audio are functioning properly.

Upon applying power to the monitor, verify the following:

- The monitor produces three (3) audio beeps from its internal speaker.
- The two (2) light bars and the Alarm Silence Visual Indicator are turned "ON" twice for one-half second and cycled one after the other.
- The monitor displays for three (3) seconds the current monitor configuration setup.

The configuration setup consists of the monitor's Model number, the version of its main software and a list of installed parameters.

NOTE:
If the printer was powered "ON" during the monitor's power-up sequence, the Midmark is printed.

Once the Power On Self-Test is completed, the monitor's Main display screen is ready for use. Refer to the Setup and Parameters menus to configure the monitor.

SETUP MENU

WARNING:
Do not enter the Setup menu while the monitor is connected to a patient. The patient is not being monitored while in the menu.

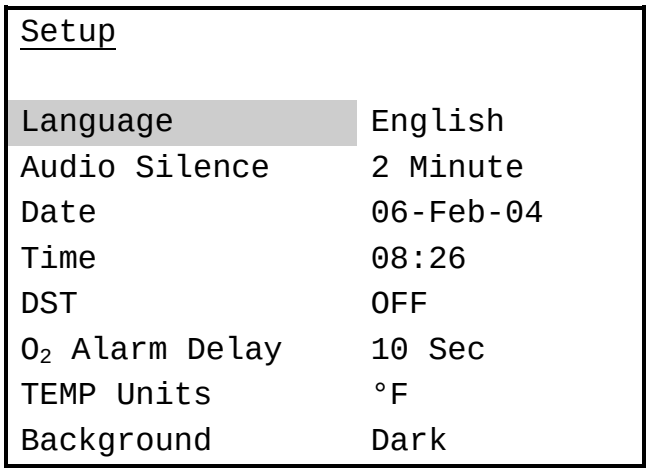
The monitor's Setup menu allows the user to tailor the Midmark Monitor to your individual needs. Once entered, the user can:

- Set the Operating Language
- Make selections for Audio Alarm Silence
- Set the Date
- Set the Time
- Set Daylight Saving Time Options
- Set the SpO_2 Pulse Rate Alarm Delay Time
- Select the Temperature Units
- Select the Trace Background

ENTERING THE SETUP MENU

To enter the monitor's Setup menu, depress and hold the ALARM LIMITS and AUDIO/VISUAL pushbutton keys while the monitor is being turned "ON".

Figure 13: **Setup Menu**



NOTE:
While in the Setup menu, if no pushbutton is depressed within 60 seconds, the monitor will automatically save all changes made, exit the Setup menu and return to the Main display screen.

EXIT THE SETUP MENU

When you have completed configuring the monitor, press the MAIN ↵ pushbutton to exit and lock in your selection(s). The monitor exits the Setup menu and returns to the Main display screen.

SELECTING THE LANGUAGE

The Midmark Monitor can operate in one (1) of nine (9) languages: English, German, French, Italian, Spanish, Dutch, Swedish Portuguese or Norwegian.

To configure the monitor's operating Language, follow the following procedure:

1) First enter the monitor's Setup menu. Refer to Page 43, SETUP MENU. The monitor will automatically highlight the Language parameter.
2) Press one of the NEXT programmed pushbutton keys until the cursor displays the current language being used.
3) Press either the ARROW UP or ARROW DOWN pushbutton to make a selection.
4) Press one of the PREVIOUS programmed pushbutton keys to return back to the parameter selections column. At this time the new language selection shall take effect.
5) Press the ARROW DOWN pushbutton to continue to the next parameter or press the MAIN ↵ pushbutton to exit to the Main display screen.

AUDIO ALARM SILENCE (SILENCE/RESET Pushbutton)

The Midmark Monitor's SILENCE/RESET pushbutton can be configured to have the audio associated with patient alarms set to one of the two selections below. The selections are:

- 2 Minute (Default)
- Permanent

To configure the monitor's Audio Alarm Silence, follow the following procedure:

1) First enter the monitor's Setup menu. Refer to Page 43, SETUP MENU.
2) Press the ARROW DOWN pushbutton until the parameter Audio Silence is highlighted.
3) Press one of the NEXT programmed pushbutton keys until the cursor displays the audio mode currently being used.
4) Press either the ARROW UP or ARROW DOWN pushbuttons to make a selection.
5) Press one of the PREVIOUS programmed pushbutton keys to return back to the parameter selections column.
6) Press the ARROW DOWN pushbutton to continue to the next parameter or press the MAIN ↵ pushbutton to exit to the Main display screen.

2 MINUTE AUDIO ALARM SILENCE

When the monitor is configured for the 2 Minute Audio Alarm Silence setting, use the SILENCE/RESET pushbutton to “enable or disable” audio alarms for a two (2) minute period. The SILENCE visual bell indicator, located on the front panel of the monitor will be illuminated constantly and the message “2 Minute” will be displayed in the Equipment Message Window section of the display as a reminder when enabled. At the end of two (2) minutes, the monitor will automatically exit the 2 Minute Audio Alarm Silence period and return to normal operation.

During a 2 Minute Audio Alarm Silence period, if an alarm (patient or equipment) occurs, except for Low Battery and Dead Battery, the audio alarm remains silenced for the remainder of the two-minutes and only a visual indicator is provided.

PERMANENT AUDIO ALARM SILENCE

When the monitor is configured to the Permanent Audio Alarm Silence setting, use the SILENCE/RESET pushbutton to “enable or disable” audio alarms. The SILENCE visual bell indicator, located on the front panel of the monitor will flash at a rate of one (1) second “ON” and one (1) second “OFF” and the message “Permanent” is displayed in the Equipment Message Window section of the display as a reminder when enabled.

During a Permanent Audio Alarm Silence period, if an alarm (patient or equipment) occurs, except for Low Battery and Dead Battery, the audio alarm remains silenced and only a visual indicator is provided.

SETTING THE DATE

The Midmark Monitor’s Date value is set at the factory.

To configure the monitor’s Date, follow the following procedure:

1) First enter the monitor’s Setup menu. Refer to Page 43, SETUP MENU.
2) Press the ARROW DOWN pushbutton until the parameter Date is highlighted.
3) Press one of the NEXT programmed pushbutton keys until the cursor displays the day parameter currently being used.
4) Press either the ARROW UP or ARROW DOWN pushbutton to make a selection.
5) Press one of the NEXT programmed pushbutton keys until the cursor displays the month parameter currently being used. Month of the Year (Jan, Feb, etc.).
6) Press either the ARROW UP or ARROW DOWN pushbutton to make a selection.
7) Follow steps 5 and 6 to set the year parameter. Last 2 digits of the year (2004 is displayed as 04).
8) Press one of the PREVIOUS programmed pushbutton keys to return back to the parameter selections column.
9) Press the ARROW DOWN pushbutton to continue to the next parameter or press the MAIN ↵ pushbutton to exit to the Main display screen.

SETTING THE TIME

The Midmark Monitor's Time value is set for Eastern Time and is set at the factory.

To configure the monitor's Time, follow the following procedure:

1) First enter the monitor's Setup menu. Refer to Page 43, SETUP MENU.
2) Press the ARROW DOWN pushbutton until the parameter Time is highlighted.
3) Press one of the NEXT programmed pushbutton keys until the cursor displays the hour parameter currently being used. Hour of the Day (0 – 23).
4) Press either the ARROW UP or ARROW DOWN pushbutton to make a selection.
5) Press one of the NEXT programmed pushbutton keys until the cursor displays the minute parameter currently being used. Minute of the Hour (0 – 59).
6) Press either the ARROW UP or ARROW DOWN pushbutton to make a selection.
7) Press one of the PREVIOUS programmed pushbutton keys to return back to the parameter selections column.
8) Press the ARROW DOWN pushbutton to continue to the next parameter or press the MAIN ↵ pushbutton to exit to the Main display screen.

NOTE:
Altering the Date and Time will affect the History readings, but not erase them.

DAYLIGHT SAVING TIME OPTION

The Midmark Monitor can be configured to automatically respond to time changes associated with Daylight Saving Time. The monitor can be configured to one of five Daylight Saving Time Option settings. They are:

- OFF — Daylight Saving Time is "OFF". The user is responsible for changing the time if needed. This is the default setting for the Midmark Monitor.
- N America — Daylight Saving Time "North America". Use this setting and the monitor will automatically *add* one (1) hour the first Sunday in April at 2 a.m. and *subtract* (1) hour the last Sunday in October at 2 a.m.
- EU 01:00
EU 02:00
EU 03:00 — Daylight Saving Time "European Union".

In the European Union, Daylight Saving Time begins and ends at 1 a.m. Universal Time (Greenwich Mean Time). It starts the last Sunday in March, and ends the last Sunday in October. In the EU, all time zones change at the same moment.

Select EU 01:00 if the monitor will be located in Ireland, Portugal or the United Kingdom. Select EU 03:00 for Finland. EU 02:00 can be used for all remaining countries within the European Union.

NOTE:
Enabling Daylight Saving Time will affect the History readings, but not erase them.

To configure the monitor's Daylight Savings time setting, follow the following procedure:

1) First enter the monitor's Setup menu. Refer to Page 43, SETUP MENU.
2) Press the ARROW DOWN pushbutton until the parameter DST is highlighted.
3) Press one of the NEXT programmed pushbutton keys until the cursor displays the parameter currently being used.
4) Press either the ARROW UP or ARROW DOWN pushbutton to make a selection.
5) Press one of the PREVIOUS programmed pushbutton keys to return back to the parameter selections column.
6) Press the ARROW DOWN pushbutton to continue to the next parameter or press the MAIN ↵ pushbutton to exit to the Main display screen.

SET THE SpO_2 PULSE RATE ALARM DELAY

The delay time until an alarm is generated for SpO_2 Pulse Rate can be configured to be either zero (0) seconds (no delay) or ten (10) seconds. The default value used by the Midmark Monitor is ten (10) seconds.

To change the monitor's SpO_2 Pulse Rate Alarm Delay Time, follow the following procedure:

1) First enter the monitor's Setup menu. Refer to Page 43, SETUP MENU.
2) Press the ARROW DOWN pushbutton until the parameter O_2 Alarm Delay is highlighted.
3) Press one of the NEXT programmed pushbutton keys until the cursor displays the parameter currently being used.
4) Press either the ARROW UP or ARROW DOWN pushbutton to make a selection.
5) Press one of the PREVIOUS programmed pushbutton keys to return back to the parameter selections column.
6) Press the ARROW DOWN pushbutton to continue to the next parameter or press the MAIN ↵ pushbutton to exit to the Main display screen.

SELECTING THE TEMPERATURE UNITS

The Midmark Monitor can display Temperature readings in either the Celsius (^{o}C) or Fahrenheit (^{o}F) scales. The default value used by the Midmark Monitor is Fahrenheit (^{o}F).

To configure the monitor's Temperature setting, follow the following procedure:

1) First enter the monitor's Setup menu. Refer to Page 43, SETUP MENU.
2) Press the ARROW DOWN pushbutton until the parameter TEMP Units is highlighted.
3) Press one of the NEXT programmed pushbutton keys until the cursor displays the parameter currently being used.
4) Press either the ARROW UP or ARROW DOWN pushbutton to make a selection.
5) Press one of the PREVIOUS programmed pushbutton keys to return back to the parameter selections column.
6) Press the ARROW DOWN pushbutton to continue to the next parameter or press the MAIN ↵ pushbutton to exit to the Main display screen.

TRACE BACKGROUND

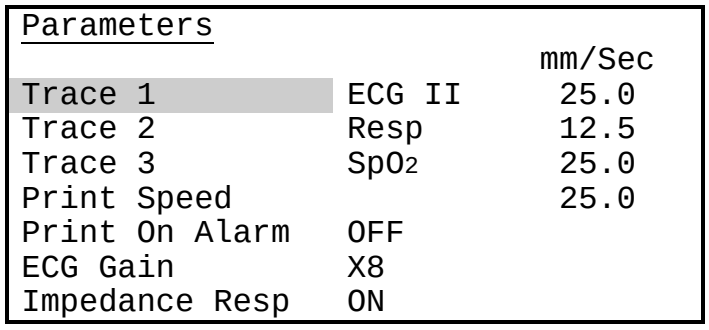
The background area surrounding the monitor's waveforms can be displayed either as: a black background with white traces (Dark) or a white background with black traces (Light). The default value used by the Midmark Monitor is Dark.

To configure the monitor's Trace Background setting, follow the following procedure:

1) First enter the monitor's Setup menu. Refer to Page 43, SETUP MENU.
2) Press the ARROW DOWN pushbutton until the parameter Background is highlighted.
3) Press one of the NEXT programmed pushbutton keys until the cursor displays the parameter currently being used.
4) Press either the ARROW UP or ARROW DOWN pushbutton to make a selection.
5) Press one of the PREVIOUS programmed pushbutton keys to return back to the parameter selections column.
6) Press the MAIN ↵ pushbutton to exit to the Main display screen.

PARAMETERS MENU

Figure 14: **Parameters Menu**



NOTE:
The Parameters pushbutton can be used at any time during monitoring. When the Parameters pushbutton is depressed, the waveforms being displayed are replaced with the Parameters menu. While in the menu, the monitor will continue to update and display the numeric values of the parameters being monitored and a signal bar graph will be displayed indicating the relative signal strength and signal quality at the sensor site.

NOTE:
While in the Parameters menu, if no pushbutton is depressed within 30 seconds, the monitor will automatically save all changes made and exit to the Main display screen.

The Parameter setup menu allows the user to:

- Trace 1
  Select and configure the waveform to be displayed in the Trace 1 area.

NOTE:
An ECG trace will automatically be selected as Trace 1.

- Trace 2
  Select and configure the waveform to be displayed in the Trace 2 area.
- Trace 3
  Select and configure display data in the Trace 3 area.
  Available selections: Trace 3 waveform data or History data

NOTE:
A continuously updating Trend History menu consisting of one (1) minute averages for HR, RR, $\%O_2$ and PR can be chosen as Trace 3. Refer to Page 53, TREND HISTORY for more information.

- Print Speed
  Select the speed the waveforms selected as Trace 1, 2 or 3 will print.
  Available selections: 25.0, 12.5, 6.25 mm/Sec

- Print On Alarm
  Select whether the monitor will automatically print to the recorder when a patient alarm condition occurs.
  Available selections: OFF or ON (The default value is OFF)

- ECG Gain
  Select the gain size of the ECG Trace.
  Available selections: Automatic: (Default value)
  Manual: Available selections (X1, X2, X4, X8)

  When Automatic is selected, the monitor's ECG module selects a gain that adjusts the waveform to be at a pleasing level on the display.

NOTE:
The gain value will appear in the upper left hand corner of the Main display screen when the ECG waveform is displayed.

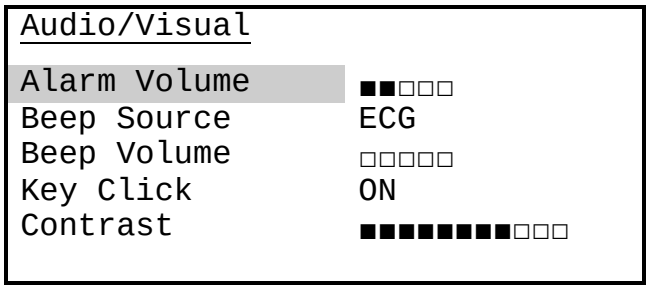
- Impedance Resp
  Configure the Respiration channel
  Available selections: OFF or ON (The default value is OFF)

To configure a parameter:

1) Press the PARAMETERS pushbutton. The parameters that are available are listed on the left hand side of the display. The monitor will initially highlight the Trace 1 parameter.
2) Press one of the NEXT programmed pushbutton keys and highlight the selections column.
3) Press either the ARROW UP or ARROW DOWN pushbutton to make a selection.
4) If Trace 1, 2, or 3 is being configured, press one of the NEXT programmed pushbutton keys to select the speed (mm/Sec) the trace will be viewed at.
5) Press either the ARROW UP or ARROW DOWN pushbutton to make a selection.
6) Press one of the PREVIOUS programmed pushbutton keys to return back to the parameter selections column.
7) Press the ARROW DOWN pushbutton to continue to the next parameter or press the MAIN pushbutton to exit and return to the Main display screen.

AUDIO/VISUAL MENU

Figure 15: **Audio/Visual Menu**



NOTE:
The Audio/Visual pushbutton can be used at any time during monitoring. When the Audio/Visual pushbutton is depressed, the waveforms being displayed are replaced with the Audio/Visual menu. While in the menu, the monitor will continue to update and display the numeric values of the parameters being monitored and a signal bar graph will be displayed indicating the relative signal strength and signal quality at the sensor site.

NOTE:
While in the Audio/Visual menu, if no pushbutton is depressed within 30 seconds, the monitor will automatically save all changes made and exit to the Main display screen.

The Audio/Visual setup menu allows the user to:

- Alarm Volume
  Adjust the Alarm Volume level.
  The Alarm Volume can be adjusted to one (1) of five (5) volume levels. Altering the Alarm Volume will produce a single tone at the selected volume level.

NOTE:
The Volume Level cannot be set to “OFF”.

- Beep Source
  Select the source of the audio “Beep”, when enabled.
  Available selections: ECG or %SpO_2

NOTE:
When %SpO_2 is selected, the monitor provides a varying pulse beep that will rise with increasing oxygen saturation and fall as saturation decreases.

- Beep Volume
  Adjust the “Beep” Volume level.
  The “Beep” Volume can be adjusted to one (1) of five (5) volume levels. Altering the “Beep” Volume will produce a single tone at a selected “non-off” volume level.
- Key Click
  Select whether an audible “click” is heard each time a pushbutton key is depressed.
  Available selections: OFF or ON
- Contrast
  Adjust the Contrast level of the display.

To configure a parameter:

1) Press the AUDIO/VISUAL pushbutton. The available items are listed on the left hand side of the display. The monitor will initially highlight the Alarm Volume selection.
2) Press one of the NEXT programmed pushbutton keys and highlight the selections column.
3) Press either the ARROW UP or ARROW DOWN pushbutton to make a selection.
4) Press one of the PREVIOUS programmed pushbutton keys to return back to the parameter selections column.
5) Press the ARROW DOWN pushbutton to continue to the next parameter or press the MAIN ↵ pushbutton to exit and return to the Main display screen.

HISTORY

The History pushbutton allows the user to recall stored Trend and Alarm History information.

Patient History is organized in two (2) visually displayed lists.

Trend History: Pressing the HISTORY pushbutton the first time reveals the first viewable list that contains up to 480 entries of Trend History. The Trend History contains one (1) minute averages of history data values for Heart Rate (HR), Respiration Rate (RR) when enabled, $\%SpO_2$ ($\%O_2$) and Pulse Rate (PR) that are saved once a minute.

Alarm History: Once in the History screen, press and hold the HISTORY pushbutton for two (2) seconds to reveal the second viewable list that contains up to 25 entries of Alarm History. The Alarm Type, the High or Low extreme value and the time the alarm occurred are also displayed.

Depress and hold the HISTORY pushbutton for two (2) seconds returns to the Trend History list.

NOTE:
The History pushbutton can be used at any time during monitoring. When the History pushbutton is depressed, the waveforms being displayed are replaced with the History menus. While in the menus, the monitor will continue to update and display the numeric values of the parameters being monitored and a signal bar graph will be displayed indicating the relative signal strength and signal quality at the sensor site.

NOTE:
While in the History menus, if no pushbutton is depressed within 30 seconds, the monitor will automatically exit to the Main display screen.

NOTE:
Both Trend and Alarm History data are only available for twenty-four (24) hours. Data older than twenty-four (24) hours is automatically removed from the history lists.

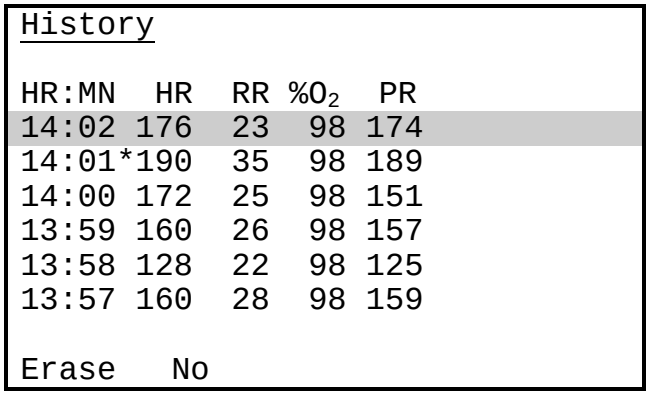
Once the HISTORY pushbutton has been depressed, depress and hold the HISTORY pushbutton for two (2) seconds to toggle between the two History screens.

NOTE:
If no alarms have occurred, the message “No Alarm History” is displayed at the top of the History menu.

When completed, press the MAIN ↵ pushbutton to exit and return to the Main display screen or after thirty (30) seconds of button inactivity the monitor will automatically return to the Main display screen.

TREND HISTORY

Figure 16: **History Menu**



To view Trend History:

1) Press the HISTORY pushbutton to enter the Patient History menu.

   The most current measurement values and the time of measurement (HR:MN) are highlighted on the front panel display screen. If there were no readings in History, the message "No History" is displayed at the top of the Main display screen when the History pushbutton is first depressed.

NOTE:
One (1) minute averages of history data values for Heart Rate (HR), Respiration Rate (RR) when enabled, $\%SpO_2$ ($\%O_2$) and Pulse Rate (PR) are saved once a minute.

NOTE:
An ***** will appear in the Trend History menu indicating an alarm occurred during that minute.

2) Press the ARROW DOWN pushbutton to review preceding measurements. The word "Oldest Entry" will be displayed briefly at the top of the display indicating there are no more readings remaining for review.

3) Press the ARROW UP pushbutton to advance the measurements towards the most current measurement taken. The word "Newest Entry" will be displayed briefly at the top of the display indicating you have reached the most current reading.

When completed, press the MAIN ↵ pushbutton to exit and return to the Main display screen or after thirty (30) seconds of button inactivity the monitor will automatically return to the Main display screen.

NOTE:
A continuously updating Trend History menu (History) can be chosen, in the Parameters Setup menu as Trace 3.

NOTE:
Turning the power “OFF” does not clear the History memory. Measurements will remain in memory for up to twenty-four (24) hours. Any measurement older than twenty-four hours is deleted. It is suggested to manually clear History between patients. Refer to ERASING TREND HISTORY on Page 55.

PRINTING TREND HISTORY

To Print the Patient History data to the printer:

1) Press the HISTORY pushbutton to enter the Patient History menu.

2) Depress and hold the PRINT pushbutton for two (2) seconds. The message “Printing” appears at the bottom of the Display Window as a status indicator.

NOTE:
Prior to accessing the Print History mode, the printer should have paper installed and the power turned “ON”. Refer to Section 9, EXTERNAL PRINTER for more information about the printer and sample printout of the History screen.

ERASING TREND HISTORY

To Erase the Patient History data:

1) Press the HISTORY pushbutton to enter the Patient History menu.

2) Press one of the NEXT programmed pushbutton keys to advance onto the parameter value to change “Erase No”.

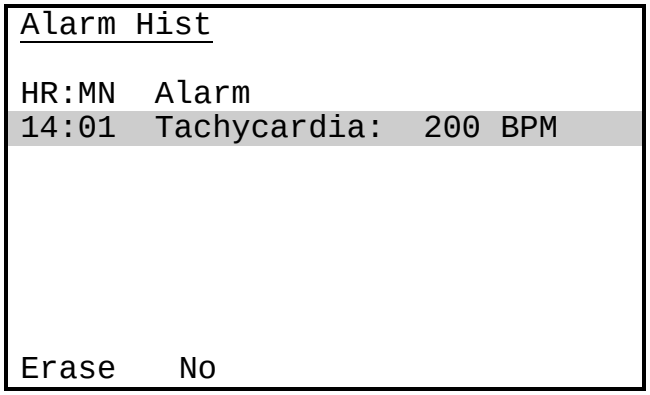
3) Press either the ARROW UP or ARROW DOWN pushbutton until the message “Erase Yes” appears.

4) Press the HISTORY pushbutton again, to erase History data.

The monitor erases the memory, enters Alarm History if available, or exits the History menu and returns to the Main display screen.

ALARM HISTORY

Figure 17: **Alarm History Menu**



To view Alarm History:

1) Press the HISTORY pushbutton to enter the Patient History menu.

2) Depress and hold the HISTORY pushbutton for two (2) seconds to enter the Alarm History menu.

NOTE:
If no alarms have occurred, the message “No Alarm History” is displayed at the top of the History menu and no Alarm History menu will be displayed.

3) The most current alarm type, the alarm parameter violated, the High or Low extreme value of that alarm and the time of the alarm (HR:MN) are highlighted on the front panel display screen.

4) Press the ARROW DOWN pushbutton to review preceding alarms. The word "Oldest Entry" will be displayed briefly at the top of the display indicating there are no more readings remaining for review.

5) Press the ARROW UP pushbutton to advance towards the most current alarm. The word "Newest Entry" will be displayed briefly at the top of the display indicating you have reached the most current reading.

When completed, press the MAIN pushbutton to exit and return to the Main display screen or after thirty (30) seconds of button inactivity the monitor will automatically return to the Main display screen.

NOTE:
Turning the power “OFF” does not clear the Alarm History memory. Alarms will remain in memory for up to twenty-four (24) hours. Any alarm older than twenty-four hours is deleted. It is suggested to manually clear Alarm History between patients. Refer to ERASING ALARM HISTORY on Page 57.

PRINTING ALARM HISTORY

To Print the Alarm History data to the printer:

1) Press the HISTORY pushbutton to enter the Patient History menu.

2) Depress and hold the HISTORY pushbutton for two (2) seconds to enter the Patient Alarm History menu.

NOTE:
If no alarms have occurred, the message “No Alarm History” is displayed at the top of the History menu and no Alarm History menu will be displayed.

3) Depress and hold the PRINT pushbutton for two (2) seconds. The message “Printing” appears at the bottom of the Display Window as a status indicator.

NOTE:
Prior to accessing the Print History mode, the printer should have paper installed and the power turned “ON”. Refer to Section 9, EXTERNAL PRINTER for more information about the printer and sample printout of the History screen.

ERASING ALARM HISTORY

To Erase the Alarm History data:

1) Press the HISTORY pushbutton to enter the Patient History menu.

2) Depress and hold the HISTORY pushbutton for two (2) seconds to enter the Patient Alarm History menu.

NOTE:
If no alarms have occurred, the message “No Alarm History” is displayed at the top of the History menu and no Alarm History menu will be displayed.

3) Press one of the NEXT programmed pushbutton keys to advance onto the parameter value to change “Erase No”.

4) Press either the ARROW UP or ARROW DOWN pushbutton until the message “Erase Yes” appears.

5) Press the HISTORY pushbutton again, to erase Patient Alarm History data.

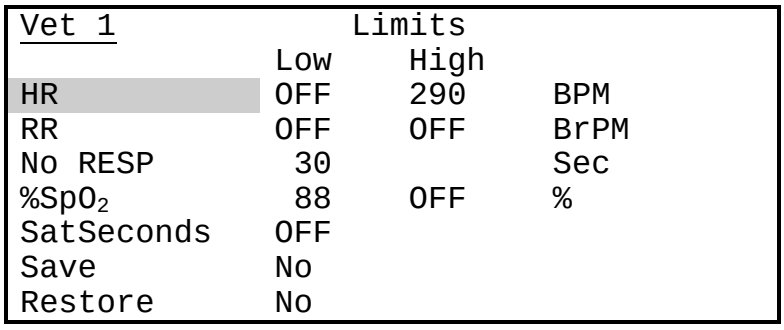
The monitor erases the memory, exits the Alarm History screen and returns to the Patient History display screen, if available, or returns to the Main display screen.

REAL TIME CLOCK

The Midmark Monitor uses an internal Real Time Clock to time stamp all entries that are stored in either of its History menus. Changes made to either the time or date settings, should be performed in-between patients being monitored. Refer to Page 45 for Setting the Date and Page 46 for Setting the Time.

PATIENT ALARMS

Figure 18: **Alarm Limits Menu**



WARNING:

The Midmark Monitors are equipped with non-latching patient alarm(s). As soon as the monitored parameter(s) return within the adjusted limits, the alarm is silenced and reset automatically without any operator interaction.

WARNING:

Configuring the Midmark Monitor's alarm settings to "OFF" will disable all audible and visual alarms. This mode should only be selected for spot check applications where the patient is receiving bedside surveillance by a trained clinician. Refer to Page 44 AUDIO ALARM SILENCE (SILENCE/RESET Pushbutton) for more information.

The Midmark Monitor is equipped with patient alarms to warn the user if any measurement parameter is outside the range of a user set value. This feature will allow the user to set values for:

Table 4: **Alarm Parameters**

Parameter			Value
Heart Rate	Low	High	BPM
Respiration Rate	Low	High	BrPM
No Respiration	Low	N/A	Sec
Pulse Oximetry	Low	High	%

The Midmark Monitor is also equipped with the ability to save two (2) independent sets of Alarm Limit values for both Vet 1 and Vet 2 modes that can be recalled. There is also a provision to Recall the Factory defaults if needed.

NOTE:
The Alarm Limits pushbutton can be used at any time during monitoring. When the Alarm Limits pushbutton is depressed, the waveforms being displayed are replaced with the Limits menu. While in the menu, the monitor will continue to update and display the numeric values of the parameters being monitored and a signal bar graph will be displayed indicating the relative signal strength and signal quality at the sensor site.

NOTE:
While in the Limits menu, if no pushbutton is depressed within 30 seconds, the monitor will automatically save any changes made and exit to the Main display screen.

CHANGING ALARM LIMITS

Press the ALARM LIMITS pushbutton and the monitor's front panel displays the currently used set of alarm setting of all Low and High Alarm Limit values along with the numeric values of the parameters currently being monitored.

To change an Alarm Limit:

1) Press the ARROW UP or ARROW DOWN pushbuttons to select a parameter value.
2) Press one of the NEXT programmed pushbutton keys to advance onto the parameter value to change (Low or High).
3) Press either the ARROW UP or ARROW DOWN pushbutton to change the parameter's value.
4) Press one of the PREVIOUS programmed pushbutton keys to return back to the parameter selections column.
5) Press either the ARROW UP or ARROW DOWN pushbutton to select the next parameter limit to change.

When finished, press the MAIN pushbutton to exit and return to the Main display screen or after thirty (30) seconds of button inactivity the monitor will automatically return to the Main display screen. The alarm value(s) set will now be used until power is turned "OFF".

SAVING ALARM LIMITS

The Midmark Monitor has the ability to save two (2) independent sets of Alarm Limit values (Vet 1 or Vet 2).

To save the Alarm Limit values to non-volatile memory:

1) Press the ALARM LIMITS pushbutton to enter the Limits menu.
2) Press the ARROW DOWN pushbutton and highlight "Save".
3) Press one of the NEXT programmed pushbutton keys to advance onto the parameter value to change (No).

4) Press either the ARROW UP or ARROW DOWN pushbutton and select the appropriate Alarm set to save (Vet 1).

5) Press the ALARM LIMITS pushbutton, the message “Saving” appears briefly as a status indicator and the current values will be saved in memory.

When finished, press the MAIN pushbutton to exit and return to the Main display screen or after thirty (30) seconds of button inactivity the monitor will automatically return to the Main display screen. The Alarm Limit values will be retained in memory even after the monitor’s power is turned “OFF”.

If a second set of Alarm Limits is required, re-enter the Alarm Limits menu, make your changes, and save the set as (Vet 2).

RESTORE A PREVIOUSLY SAVED SET OF LIMITS

To restore a previously saved set of Alarm Limit settings (ex. From Vet 2 to Vet 1):

1) Press the ALARM LIMITS pushbutton to enter the Limits menu.

2) Press the ARROW DOWN pushbutton and highlight “Restore”.

3) Press one of the NEXT programmed pushbutton keys to advance onto the parameter value to change (No).

4) Press either the ARROW UP or ARROW DOWN pushbutton and select the appropriate set of Alarm Limits that the monitor will use.

5) Press the ALARM LIMITS pushbutton, the message “Restoring” appears briefly as a status indicator. The restored values will be saved to memory.

When finished, press the MAIN pushbutton to exit and return to the Main display screen or after thirty (30) seconds of button inactivity the monitor will automatically return to the Main display screen. The Alarm Limit values will be retained in memory even after the monitor’s power is turned “OFF”.

RESTORE FACTORY DEFAULTS

To restore the Factory default settings:

1) Press the ALARM LIMITS pushbutton to enter the Limits menu.

2) Press the ARROW DOWN pushbutton and highlight “Restore”.

3) Press one of the NEXT programmed pushbutton keys to advance onto the parameter value to change (No).

4) Press either the ARROW UP or ARROW DOWN until the message “Factory” appears.

5) Press the ALARM LIMITS pushbutton, the message “Restoring” appears briefly as a status indicator and the Factory set of Alarm values will be restored into the current memory location.

When finished, press the MAIN ↵ pushbutton to exit and return to the Main display screen or after thirty (30) seconds of button inactivity the monitor will automatically return to the Main display screen. The Alarm Limit values will be retained in memory even after the monitor's power is turned "OFF".

ALARM LIMIT VALUES

Table 5, lists the Alarm Limit Default Values used by the Midmark Monitor.

Table 5: **Factory Default Alarm Values**

Parameter		**Limits**	
		Low	**High**
Heart Rate	HR	OFF	290
Respiration Rate	RR	OFF	OFF
No Respiration Rate	No RESP	30	N/A
%SpO_2	%SpO_2	88	OFF
SatSeconds	SatSeconds	OFF	N/A

NOTE:
Patient alarms for Heart Rate have a five (5) second delay. The alarm for %SpO_2 has a zero (0) second or SatSeconds delay. The alarm for Pulse Rate will have a zero (0) second or ten (10) second delay when taken from the SpO_2 signal (no ECG).

NOTE:
When Respiration is turned OFF, no Respiration Rate (RR) Limits will appear.

AUDIBLE AND VISUAL INDICATORS

The Midmark Monitor is capable of producing both an audible and a visual indicator for a variety of monitor conditions. The following table provides a cross reference for audible and visual indications.

Table 6: **Audible and Visual Indicators**

Alarm Condition	Priority Level	Audible Indication	Visual Indication
Dead Battery	High	3 Beeps followed by 2 Beeps every 10 seconds	The message is displayed continuously on the monitor's Main display screen. The Equipment Alarm LEDs are flashing. The Battery Power visual indicator is Red.
Patient Alarm Limit Violations	High	3 Beeps followed by 2 Beeps every 10 seconds	The associated numeric display flashes for one second on / one second off for the parameter limit in violation. The Patient Alarm LEDs are flashing. The message is displayed for one second every two to four seconds in the Patient Alarm Message Window section of the display.
Power Failure	High	3 Beeps followed by 2 Beeps every 10 seconds	The message is displayed for one second every two to six seconds in the Equipment Message Window section of the display *****. The Equipment Alarm LEDs are flashing.
Low Battery Alarm	Medium	3 Beeps every 25 seconds	The message is displayed for one second every two to six seconds in the Equipment Message Window section of the display *****. The Battery Charge Status visual indicator is flashing for one second on / one second off on the display. The Equipment Alarm LEDs are flashing. The Battery Power visual indicator is Red.

AUDIBLE AND VISUAL INDICATORS (cont)

Table 6: **Audible and Visual Indicators**

Alarm Condition	Priority Level	Audible Indication	Visual Indication
Equipment Alarms	Medium	3 Beeps every 25 seconds	The appropriate message is displayed for one second on / one second off in either the Waveform section or Equipment Message Window section of the display *****. The Equipment Alarm LEDs are flashing.
ECG Heart Beat	Low	1 Beep coincides with each received ECG heart rate	Numerics are updated with each received heart rate value.
SpO_2 Pulse Beat	Low	1 Beep coincides with each received SpO_2 pulse rate	Numerics are updated with each received SpO_2 pulse rate value.
Key Click	Low	1 Beep associated with each button action	None

***** - The message interval time will vary based on what monitor conditions are present. If the Equipment Alarm is associated with a selected waveform being viewed, the Alarm message appears in the Waveform section of the display.

NOTE:
Refer to the Tables starting on Page 72 for a listing of messages that may be displayed on the Main display screen.

CLEARING ALARMS

The Midmark Monitor provides to the user an audible and visual indication for both patient and equipment alarm conditions.

WARNING:
The Midmark Monitors are equipped with non-latching patient alarm(s). As soon as the monitored parameter(s) return within the adjusted limits, the alarm is silenced and reset automatically without any operator interaction.

ECG HEART RATE ALARMS

During either a Low or High ECG Heart Rate Alarm Limit Violation, the monitor flashes the Heart Rate (HR) numeric display and the Patient Alarm LEDs, provides a Patient Alarm Limit Violation audible tone and flashes the appropriate message (Bradycardia or Tachycardia) in the Patient Alarm Message Window section of the display.

To acknowledge the alarm and temporarily mute the audio, depress the SILENCE/RESET pushbutton.

The monitor silences the audible tone for a maximum of fifteen (15) seconds, the parameter in alarm and Patient Alarm LEDs continue to flash on the front panel and the appropriate message will be displayed in the Patient Alarm Message Window section of the display. If the current patient alarm condition becomes inactive during the 15 seconds and then recurs OR a different patient alarm condition occurs during the 15 seconds, the audio alarm is reactivated. If the alarm condition continues uninterrupted for the 15 seconds, the audio alarm is reactivated.

RESPIRATION ALARMS

During either a Low or High Respiration Alarm Limit Violation, the monitor flashes the Respiration Rate (RR) numeric display and the Patient Alarm LEDs, provides a Patient Alarm Limit Violation audible tone and flashes the appropriate message (Low RR or High RR) in the Patient Alarm Message Window section of the display.

To acknowledge the alarm and temporarily mute the audio, depress the SILENCE/RESET pushbutton.

The monitor silences the audible tone for a maximum of fifteen (15) seconds, the parameter in alarm and Patient Alarm LEDs continue to flash on the front panel and the appropriate message will be displayed in the Patient Alarm Message Window section of the display. If the current patient alarm condition becomes inactive during the 15 seconds and then recurs OR a different patient alarm condition occurs during the 15 seconds, the audio alarm is reactivated. If the alarm condition continues uninterrupted for the 15 seconds, the audio alarm is reactivated.

%SpO_2 ALARMS

During either a Low or High %SpO_2 Alarm Limit Violation, the monitor flashes the %SpO_2 numeric display and the Patient Alarm LEDs, provides a Patient Alarm Limit Violation audible tone and flashes the appropriate message (Low %SpO_2 or High %SpO_2) in the Alarm Window section of the display.

To acknowledge the alarm and temporarily mute the audio, depress the SILENCE/RESET pushbutton.

The monitor silences the audible tone for a maximum of fifteen (15) seconds, the parameter in alarm and Patient Alarm LEDs continue to flash on the front panel and the appropriate message will be displayed in the Patient Alarm Message Window section of the display. If the current patient alarm condition becomes inactive during the 15 seconds and then recurs OR a different patient alarm condition occurs during the 15 seconds, the audio alarm is reactivated. If the alarm condition continues uninterrupted for the 15 seconds, the audio alarm is reactivated.

SpO_2 PULSE RATE ALARMS

During either a Low or High SpO_2 Pulse Rate Alarm Limit Violation, the monitor flashes the %SpO_2 Pulse Rate (PR) numeric display and the Patient Alarm LEDs, provides a Patient Alarm Limit Violation audible tone and flashes the appropriate message (Low SpO_2 PR or High SpO_2 PR) in the Alarm Window section of the display.

To acknowledge the alarm and temporarily mute the audio, depress the SILENCE/RESET pushbutton.

NOTE:
For SpO_2 Pulse Rate alarms to be enabled, the ECG parameter must be in LEADS OFF condition.

The monitor silences the audible tone for a maximum of fifteen (15) seconds, the parameter in alarm and Patient Alarm LEDs continue to flash on the front panel and the appropriate message will be displayed in the Patient Alarm Message Window section of the display. If the current patient alarm condition becomes inactive during the 15 seconds and then recurs OR a different patient alarm condition occurs during the 15 seconds, the audio alarm is reactivated. If the alarm condition continues uninterrupted for the 15 seconds, the audio alarm is reactivated.

EQUIPMENT ALARMS

During an active Equipment Alarm, the monitor displays the alarm parameter in either the Waveform section or the Equipment Message Window section of the display, flashes the Equipment Alarm LEDs and provides an Equipment Alarm audible tone.

To acknowledge the alarm, depress the SILENCE/RESET pushbutton.

The monitor silences the audible and visual alarms and clears the parameter from the display.

NOTE:
The Low Battery and Dead Battery alarms cannot be silenced.

2 MINUTE AUDIO ALARM SILENCE

NOTE:
Enabling the 2 Minute Audio Silence mode can only be accomplished after all active alarm conditions have been addressed. To clear an alarm, refer to Page 63, CLEARING ALARMS.

If the 2 Minute Audio Silence mode is selected in the Audio Silence portion of the Setup menu, pressing the SILENCE/RESET pushbutton will temporarily deactivate the audio alarms for two (2) minutes. The SILENCE visual indicator will illuminate continuously and the message “2 Minute” will be displayed in the Equipment Message Window section of the display as a reminder.

When the 2 Minute Audio Silence is enabled, the monitor will not alarm for patient related High and Low Alarms and Equipment Alarms. The monitor will alarm for Low Battery and Dead Battery.

To re-activate the audio alarm, press the SILENCE/RESET pushbutton again. The visual indicators will go out. If the button is not pressed, audible alarms will be re-armed automatically after two (2) minutes. Refer to Page 44, AUDIO ALARM SILENCE (SILENCE/RESET Pushbutton) for more information.

PERMANENT AUDIO ALARM SILENCE

NOTE:
Enabling the Permanent Audio Silence mode can only be accomplished after all active alarm conditions have been addressed. To clear an alarm, refer to Page 63, CLEARING ALARMS.

If the Permanent Audio Silence mode is selected in the Audio Silence portion of the Setup menu, pressing the SILENCE/RESET pushbutton will deactivate the audio alarms. The SILENCE visual indicator will flash at a rate of one (1) second “ON” and one (1) second “OFF” and the message “Permanent” will be displayed in the Equipment Message Window section of the display as a reminder.

When the Permanent Audio Silence is enabled, the monitor will not alarm for patient related High and Low Alarms and Equipment Alarms. The monitor will alarm for Low Battery and Dead Battery.

To re-activate the audio alarm, press the SILENCE/RESET pushbutton again. The visual indicators will go out. Refer to Page 44, AUDIO ALARM SILENCE (SILENCE/RESET Pushbutton) for more information.

BATTERY POWER

The Midmark Monitor is equipped with an internal rechargeable battery. The battery is charging whenever the monitor is plugged into the AC wall outlet. A Battery Power Visual Indicator, located on the front panel, indicates the status condition of the monitor’s battery.

Batteries will self-discharge when they are not used. It is recommended that the battery be maintained at full charge by leaving the monitor connected to the AC wall outlet whenever possible.

The 7.2 Volt 3700 mAhr battery pack, when fully charged, is capable of running the monitor for approximately four (4) hours.

NOTE:
Operation time is based on a Model 9454 monitor.

BATTERY MESSAGES

When the message "Low Battery" appears in the Equipment Message Window section of the display, at least thirty (30) minutes of battery operation remain and the monitor’s battery pack should be charged as soon as possible.

During a Low Battery condition, the monitor displays the message “Low Battery” in the Alarm Message Window section of the display, flashes the Battery Charge Status visual indicator and the Equipment Alarm LEDs and provides an Equipment Alarm audible tone. Also, the front panel Battery Power visual indicator changes from Orange to Red.

WARNING:
Upon the detection of a Low Battery condition and if the battery is not charged by the user, the monitor may no longer function as intended. The monitor should be plugged into a power source as soon as possible and the battery allowed to charge for five (5) hours.

NOTE:
A Low Battery alarm cannot be silenced.

When the "Dead Battery" message appears, the battery is no longer able to power the monitor. During a Dead Battery condition, the message "Dead Battery" is displayed continuously on the Main display screen, the Equipment Alarm LEDs are flashing, the Battery Power visual indicator is colored Red and three (3) audio “beeps” followed by two (2) audio “beeps” once every ten (10) seconds are heard until the power is turned off.

WARNING:
Upon the detection of a Dead Battery condition and if the monitor is not turned off by the user, the monitor shuts down and turns “OFF” after three (3) minutes of operations.

NOTE:
A Dead Battery alarm cannot be silenced.

When either of these messages appears, it is necessary to recharge the battery. A depleted battery may be fully recharged in five (5) hours. The monitor can be used to obtain measurements while the battery is charging.

NOTE:
Using the monitor while charging may lengthen the time to restore battery charge.

NOTE:
During charging of the battery, the case may feel warm to the touch.

CHECKING BATTERY STATUS

If your Midmark Monitor is equipped with the standard battery pack, the following applies;

1) When the monitor is connected to the AC wall outlet the Battery Charge Status visual indicator will have a moving bar from left to right within the indicator signifies the battery is being charged. Once charged, the moving bar will stop and the battery icon will be completely filled in.
2) When the monitor is being powered from the battery, the moving bar within the Battery Charge Status visual indicator will be moving from right to left signifying the battery is being discharged.

If your Midmark Monitor is equipped with a Smart Pack battery, the following applies;

The monitor's Main Board receives information from electronics enclosed within the battery pack. The status of the battery pack can be verified using one of the following methods:

1) When the monitor is connected to the AC wall outlet and is powered "OFF", the Main display screen will display; the % charge of the battery pack (XXX %), where "XXX" represents the percent (0 to 100) of the full charge condition of the battery and the Battery Charge Status visual indicator.

2) When the monitor is powered "ON", the Battery Charge Status visual indicator is located in the upper right hand corner of the Main display screen. The icon is filled to correspond with the level of battery charge.

3) The Midmark Monitor's Smart Battery pack contains on-board electronics, which can be used to check the status of battery charge remaining when not connected to the monitor. Depress the pushbutton located on the inside panel of the battery pack. Once depressed, four (4) LED indicators will illuminate to display the status of battery charge remaining (each LED lit is equivalent to approximately 25%).

CAUTION:
This product contains a rechargeable battery that is recyclable. Under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream. Check with your local authorities for instructions on recycling options in your area.

STAND BY

The Midmark Monitor can be placed into a Stand by mode. This mode can be used just prior to connecting the monitor to a patient, but all the monitor's cables are connected. This mode is enabled by depressing and holding for two (2) seconds the SILENCE/RESET pushbutton. When enabled, all Equipment alarms are silenced and the message "Stand By" is displayed on the Main display screen.

For the Stand by feature to work properly, the following conditions must apply;

- The monitor cannot be actively monitoring any patient parameter.

NOTE:
Temperature monitoring is not effected by the Stand By mode.

To return the monitor to normal operation, connect any of the patient leads to the patient.

POWER FAIL

The Midmark Monitor incorporates a Power Fail feature. Whenever the power is disconnected from the monitor and the monitor is not allowed to shut down in an orderly fashion, the monitor, when re-powered alerts the user.

The message “Power Failure” is displayed in the Equipment Message Window, the Equipment Alarm LEDs are flashing and three (3) audio “beeps” followed by two (2) audio “beeps” are heard every ten (10) seconds.

During this condition, all other pushbuttons are inactive except for the ON/STANDBY and SILENCE/RESET.

To clear the Power Fail condition, depress the SILENCE/RESET pushbutton or properly recycle the monitor’s power.

USER MESSAGES

WARNING:
The Midmark Monitors are equipped with non-latching equipment alarm(s). As soon as the monitored parameter(s) return within the adjusted limits, the alarm is silenced and reset automatically without any operator interaction.

The Midmark Monitor displays a variety of messages to aid the user in monitor operation. If a troubleshooting message is displayed during a measurement, follow the actions listed to correct the situation.

If the monitor does not turn on, or exhibits a flashing display and failure to operate, the battery is most likely below the Dead Battery point. Connect the monitor to an AC wall outlet and allow it to charge for five (5) hours.

NOTE:
Refer to the Tables starting on Page 72 for a listing of messages that may be displayed on the Main display screen.

If the monitor is in need of repair, it must be referred to the appropriate service personnel. Service performed by unauthorized personnel could be detrimental to the monitor and will void the warranty. For service, contact CAS Medical Systems, Inc.

ECG/RESPIRATION USER MESSAGES

If the accuracy of any measurement does not seem reasonable, first check the patient's vital signs by an alternate method.

If one of the leadwires should become disconnected from the patient, the waveform trace(s) will become blank, the message "Leads OFF" will be displayed in the waveform section of the display, the Heart Rate and Respiration Rate numeric displays will show dashes "- - -", the Equipment Alarm LEDs will flash and three (3) audio "beeps" are heard every twenty-five (25) seconds for as long as the condition continues.

To acknowledge the alarm, depress the SILENCE/RESET pushbutton.

The monitor silences the audible and visual alarms and the message "Leads OFF" remains on the display.

If the ECG/Respiration Module located inside the Midmark Monitor should fail, the message "ECG Error" or "ECG Module" is displayed, the Heart Rate and Respiration Rate numeric displays will show dashes "- - -", the Equipment Alarm LEDs will also flash and three (3) audio "beeps" are heard every twenty-five (25) seconds.

To acknowledge the alarm, depress the SILENCE/RESET pushbutton.

The monitor silences the audible and visual alarms, but the message "ECG Error" or "ECG Module" remains on the display.

Should the above problems persist, contact CAS Medical Systems, Inc.

SpO_2 USER MESSAGES (Model 9454 only)

If the accuracy of any measurement does not seem reasonable, first check the patient's vital signs by an alternate method.

NOTE:
The SpO_2 probe must be kept as motionless as possible to make a proper determination. Use the SpO_2 waveform display to determine if a strong rhythmic pulse signal is present.

When no oximeter probe is attached to the monitor, the %SpO_2 and Pulse Rate numeric displays will show dashes "- - -", and the signal strength window will be blank.

NOTE:
If SpO_2 is selected as a waveform parameter, no signal strength bar graph is displayed.

When the probe is connected to the monitor, but is off of the patient, the %SpO_2 and Pulse Rate numeric displays will show dashes "- - -". The message "SpO_2 Probe OFF" is displayed, the Equipment Alarm LEDs are flashing and three (3) audio "beeps" are heard every twenty-five (25) seconds.

NOTE:
If SpO_2 is selected as a waveform parameter, the message appears in the waveform section of the display. If SpO_2 is not selected as a waveform parameter, the message appears in the equipment message window section of the display.

To acknowledge the alarm, depress the SILENCE/RESET pushbutton.

The monitor silences the audible and visual alarms, but the message "SpO_2 Probe OFF" remains on the display.

If the message "Chk SpO_2 Probe" should appear, verify that the probe being used is not defective by replacing the defective one and trying a different probe. The message "Chk SpO_2 Probe" is displayed, the Equipment Alarm LEDs are flashing and three (3) audio "beeps" are heard every twenty-five (25) seconds.

NOTE:
If SpO_2 is selected as a waveform parameter, the message appears in the waveform section of the display. If SpO_2 is not selected as a waveform parameter, the message appears in the equipment message window section of the display.

To acknowledge the alarm, depress the SILENCE/RESET pushbutton.

The monitor silences the audible and visual alarms, but the message "Chk SpO_2 Probe" remains on the display.

If the SpO_2 Module located inside the Midmark Monitor should fail, the message "SpO_2 Error" or "SpO_2 Module" is displayed. The %SpO_2 and Pulse Rate numeric displays will show dashes "- - -", the Equipment Alarm LEDs are flashing and three (3) audio "beeps" are heard every twenty-five (25) seconds.

NOTE:
If SpO_2 is selected as a waveform parameter, the message appears in the waveform section of the display. If SpO_2 is not selected as a waveform parameter, the message appears in the equipment message window section of the display.

To acknowledge the alarm, depress the SILENCE/RESET pushbutton.

The monitor silences the audible and visual alarms, but the message "SpO_2 Error" or "SpO_2 Module" remains on the display.

Should any of the above problems persist, contact CAS Medical Systems, Inc.

MONITOR MESSAGES

MONITOR

Table 7: **Monitor Messages**

MONITOR MESSAGE	POSSIBLE CAUSE	POSSIBLE SOLUTION
“Clock Battery”	The monitor’s internal clock battery is almost discharged.	Contact CAS Medical Systems to have the monitor serviced.
"Dead Battery"	The battery is fully discharged.	Recharge the battery for at least 5 hours.
"Low Battery"	The battery is almost discharged.	At least 30 minutes of operation is available from when the message first appears. Recharge the battery as soon as possible.
"System Error"	An electronic failure has occurred within the monitors’ Main Board.	Contact CAS Medical Systems to have the monitor serviced.
"Power Failure"	Power was disconnected from the monitor.	Depress the SILENCE/RESET pushbutton to clear the message. OR Turn the monitor Off, then back On to clear the message.
“Set Clock”	The monitor’s clock needs to be set.	The monitor’s time and date values are incorrect. Refer to Page 45 for information to set the Date and Page 46 to set the Time. The monitor’s internal clock battery needs to be replaced. Contact CAS Medical Systems.

MONITOR MESSAGES (cont.)

ECG/RESPIRATION

Table 8: **ECG/Respiration Monitor Messages**

MONITOR MESSAGE	POSSIBLE CAUSE	POSSIBLE SOLUTION
"ECG Error"	A communication failure has occurred with the monitors' ECG Board.	Contact CAS Medical Systems to have the monitor serviced.
"ECG Module"	An electronic failure has occurred within the monitors' ECG Board.	Contact CAS Medical Systems to have the monitor serviced.
"Leads OFF"	The leadwires may be disconnected.	Check the leadwires at the electrode end and at the patient cable to be sure they are connected securely.
	The patient cable may be disconnected.	Check the patient cable jack on the monitor to be sure it is plugged in securely.
	The leadwires or patient cable may be broken.	Replace the leadwires or patient cable.
	The electrodes may be old.	Replace the electrodes.

MONITOR MESSAGES (cont.)

SpO_2

Table 9: **SpO_2 Monitor Messages**

MONITOR MESSAGE	POSSIBLE CAUSE	POSSIBLE SOLUTION
"Chk SpO_2 Probe"	The monitor is questioning the quality of the signal being received by the SpO_2 sensor. The sensor is receiving too much ambient light.	Verify that the sensor is being used according to the manufacturer's recommendations. Verify that the sensor emitter and detector are parallel to and directly opposing each other.
"No SpO_2 Probe"	The monitor is not detecting the SpO_2 probe.	The probe was disconnected from either the Interface Cable or from the monitor.
"Pulse Search"	The monitor is searching for a Pulse signal.	Normal at power-up as the monitor searches for a pulse. The probe position may have changed. Check the probe site.
"Probe Error"	The SpO_2 probe being used is not the correct one for the monitor's configuration.	Verify the probe being used is the correct probe.
"SpO_2 Probe OFF"	The monitor is no longer receiving a patient signal from the SpO_2 probe.	The probe is no longer in contact with the patient. Check the probe site.
"SpO_2 Error"	An electronic failure has occurred within the SpO_2 module.	Contact CAS Medical Systems to have the monitor serviced.

9. EXTERNAL PRINTER

The following section is provided as an overview of the Citizen CMP-10 Mobile Printer as it is used with the Midmark Monitor.

NOTE:
For more detailed information on the Citizen Model CMP-10 Mobile Printer, refer to the User's Manual that was supplied with the printer.

WARNING:
The Midmark Monitor has been tested with the Citizen CMP-10 Mobile printer to comply with IEC 60601-1 and is the only printer that is recommended to be used with the monitor. If another printer is to be used, the user must read the Caution on Page 16 under LEAKAGE CURRENT TEST and follow the guidance given.

NOTE:
The Midmark Monitor is not equipped with interfaces to remote equipment or network(s) to duplicate alarms.

PRINTER OVERVIEW

The Citizen CMP-10 Mobile Printer interfaces to the Midmark Monitor via an Infrared (Ir) port or by using the direct connect RS232 cable (supplied with printer). The Infrared ports are located on the top of the printer and on the bottom front panel of the Midmark Monitor.

When using the Infrared port, it is important to keep the two devices close together (less than three (3) Feet/one (1) Meter) and in-line to maintain proper communications. The monitor can perform a communication test to verify the Infrared connection. Refer to Page 91, IrDA TEST for more information.

CAUTION:
For safe and proper usage of the external printer, please observe the following:

When using the printer:

- Avoid placing monitor in areas where fluid may enter the printer opening accidentally.
- Do not drop or bump the monitor.
- Avoid places subject to high or low temperature extremes.
- Avoid direct sunlight.
- Avoid dusty places and where corrosive gasses are generated.
- Never attempt to dismantle or repair the printer mechanism.

When handling the thermal paper:

- Store in a dark, cool and dry place.
- Do not place near organic solvents.
- Avoid contact with vinyl chloride films erasers or adhesive tapes for extended periods.
- Avoid exposure to high temperature, humidity, liquid, or sunlight.
- Always use specified thermal paper (CAS P/N 28-02-0077).

PRINTER CONTROLS AND INDICATORS

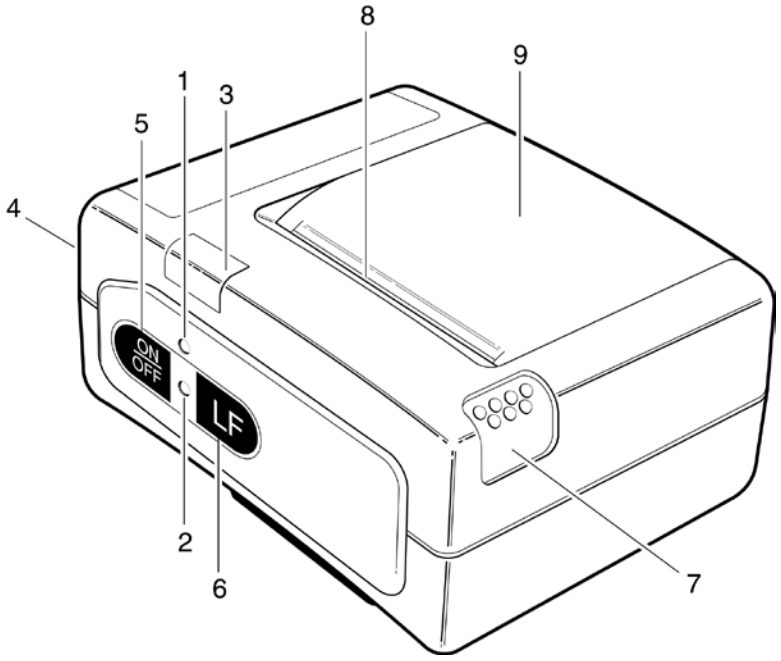


Figure 19: **Printer Controls and Indicators**

- LED Indicators (Bicolor – Red and Green)

1. CHARGE LED
   Red on – Charging Battery
   Green on – Battery is fully charged

2. Power (Error) LED
   Green on – Device is switched “ON” or self-testing is in progress
   Red/Green blinking fast - End of paper
   Red/Green blinking slow - Print Head Overheated

- Controls

3. Infrared (IrDA) port
4. RS 232 Serial Port
5. Power ON/OFF switch
6. Line Feed button — press once for one (1) line paper feed
   press down and hold for continuous paper feed to any length
7. Paper Cover Release Button - Press down to open cover
8. Paper Cutting Edge
9. Paper Cover

PRINTER OPERATION

Position the printer's Infrared port window in-line with the Infrared window of the Midmark Monitor OR connect the RS232 direct cable from the printer to the 9-pin RS 232 connector, located on the rear panel of the Midmark Monitor.

NOTE:
The Midmark Monitor incorporates an IrDA Test. The test can be used to establish the proper alignment of the Infrared ports. Refer to Page 91, IrDA TEST for more information.

NOTE:
When using the IrDA port for printing, it is recommended to keep all items clear of the communications path between the monitor and the printer.

Turn the printer "ON". To turn the printer "ON", press and hold the ON/OFF pushbutton for one (1) second. The Power LED illuminates Green.

To turn the printer "OFF", press and hold the ON/OFF pushbutton. The Power LED will illuminate Red and change back to Green. When the LED illuminates Green, remove your finger from the pushbutton.

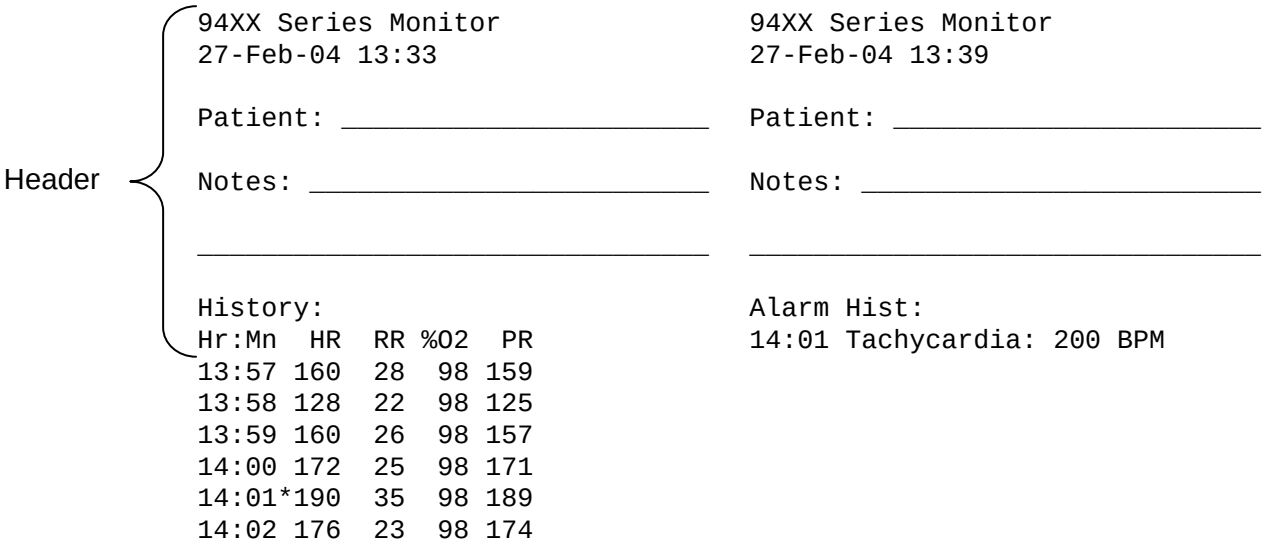
The CMP-10 Mobile Printer contains an Auto Power Off feature. If the monitor and printer become separated and after ten (10) minutes during which no data has been sent to the printer and the Line Feed (LF) pushbutton has not been depressed, the printer will automatically shutoff.

The Midmark Monitor will periodically send to the printer a "wake-up" message that will disable the Auto Power Off feature.

NOTE:
If the printer was powered "ON" during the monitor's power-up sequence, the Midmark logo is printed.

Sample printouts of both History Modes are shown below.

Figure 20: **History Sample Printouts**



NOTE:

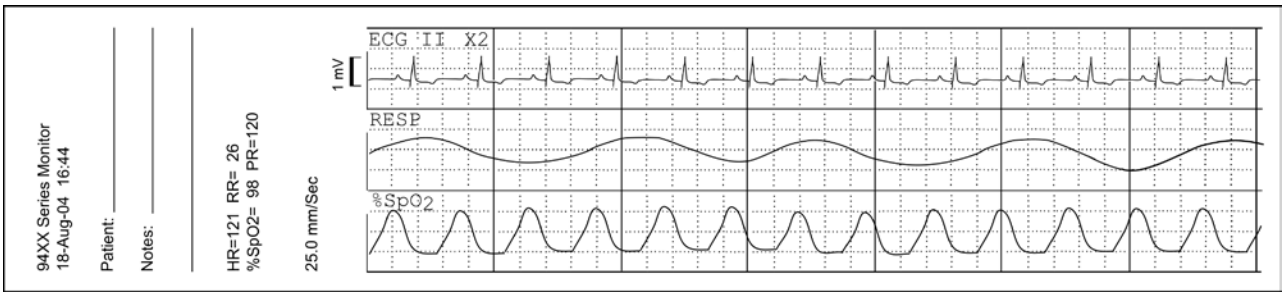
The monitor's Header information is printed each time the monitor is turned "ON".

An asterisk (*) appears in the History printout to indicate an Alarm has occurred during that one-minute time frame. The alarm value shown represents the extreme value during the alarm time.

NOTE:

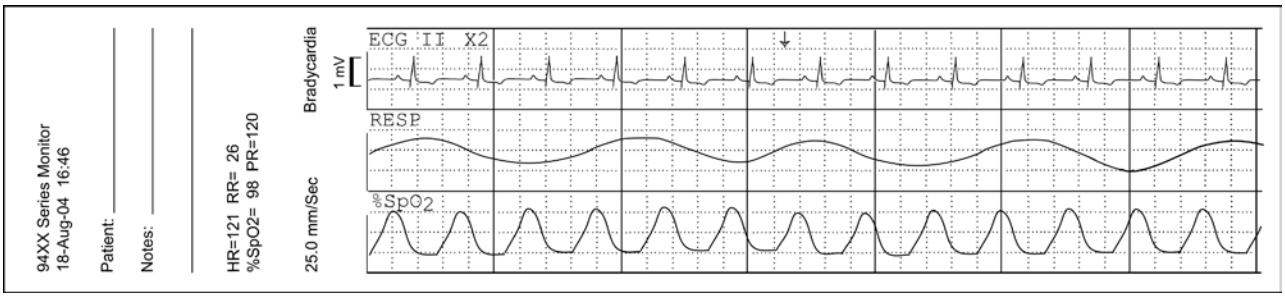
When Respiration is turned OFF, no Respiration Rate (RR) readings will appear.

Figure 21: **Waveform Sample Printouts**



To print waveforms, depress and hold for two (2) seconds the FREEZE, PRINT, MAIN pushbutton ↵ while in the Main display screen. The waveforms being displayed will print based on the Print Trace selections in the Parameters menu. Refer to Page 49, PARAMETERS MENU for the Print Trace selections.

When the Print On Alarm setting in the Parameters menu is set to “ON”, the type of alarm is printed on the printout and the trace is annotated with an arrow marker to mark the point of the alarm.



CHARGING THE PRINTER BATTERY

The CMP-10 Mobile Printer is equipped with a rechargeable Lithium Ion (LiION) battery pack.

When the printer detects a Low Battery condition within itself, the message “Low Battery” is printed and an audio indicator, located inside the printer sounds three (3) times.

WARNING:
Charge the printer battery using the AC Adapter, Model TRC-09-1100-M from GROUP WEST, or equivalent, included with the printer.

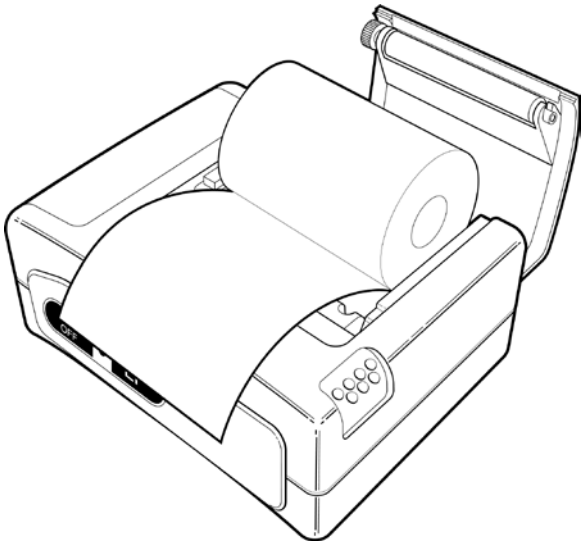
Plug the battery charger’s cord into the printer battery charger jack, located on the rear panel. Plug the charger into an AC wall outlet of the appropriate voltage. Verify the CHARGE LED indicator is lit Red. Battery charge time is approximately three (3) hours. Once the battery is fully charged, the CHARGE LED indicator switches to Green.

INSTALLING PAPER

NOTE:
A red line appears when the remaining supply of thermal paper becomes low.

1) Switch the printer “OFF”.
2) Press the Cover Open button to access the paper compartment. Remove any remaining paper before installing the new roll.
3) Place the new paper roll as shown on the illustration and pull out enough paper to reach out over the control panel of the printer.
4) Close the paper door.

Figure 22: **Paper Installation**



NOTE:
Make sure that the paper is correctly placed. If it is tilted in one or another direction and does not come out straight from under the cover, open the door and reposition the roll again.

WARNING:
Do not touch the print head or paper cutter while replacing the printer paper.

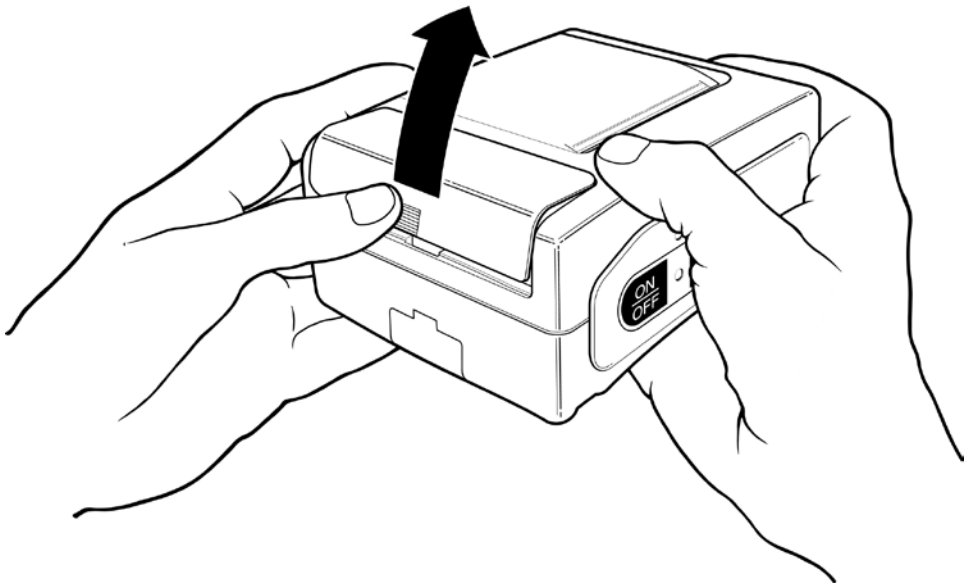
REPLACING THE BATTERY PACK

WARNING:
Do not operate the printer or connect the printer to the Midmark Monitor with the battery pack removed.

WARNING:
Never change the battery pack while the battery charger is plugged in and/or the Midmark Monitor is being operated.

1) Switch the printer “OFF”.
2) Disconnect the printer from the Midmark Monitor and unplug the wall charger cord.
3) Open the battery door by pressing in on the battery cover and pushing upward.

Figure 23: **Opening the Battery Door**



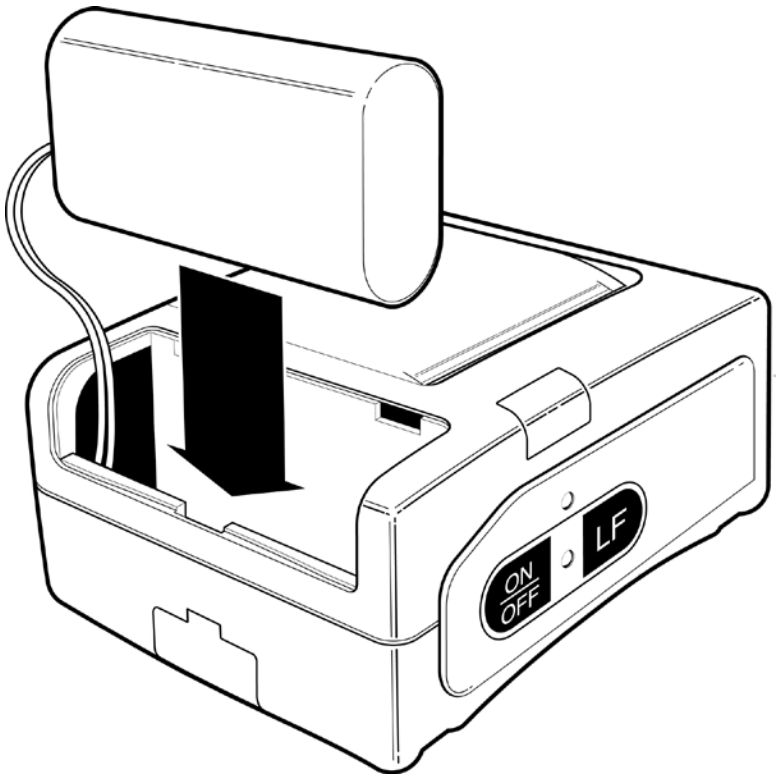
4) Remove the battery cover.
5) Remove the battery pack from the compartment and disconnect its connecting cable.

INSTALLING A NEW BATTERY PACK

1) Connect the battery cable into the battery connector.

2) Insert the battery and its connecting cable into the battery compartment.

Figure 24: **Installing the New Battery**



3) Replace the battery cover by sliding it in from the back of the printer and pushing down to lock it in place.

CAUTION:
Be sure to place the battery cover firmly in its position after installing the new battery pack.

WARNING:
Do not disassemble the battery pack or batteries. The batteries contain electrolytes, which can cause injury to eyes, skin and clothing.

NOTE:
This product contains a rechargeable battery that is recyclable. Under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream. Check with your local authorities for instructions on recycling options in your area.

PRINTING TO A COMPUTER

The Midmark Monitor uses the 9-Pin connector to interface to the optional Citizen CMP-10 Mobile printer using the cable supplied with the printer or can be connected to a data collection device such as a personnel computer. The RS232 serial communication protocol is output only, with no polling feature.

The information provided in this section is made available to allow the user the ability to print the monitor's History data to a personnel computer.

- Equipment Needed:
  9-pin, female-to female, RS-232, "Null Modem" cable

- Computer Configuration:
  Create a HyperTerminal (1) Connection

1. From your Desktop, choose Start, Programs, Accessories, Communications and select HyperTerminal.
2. Open the program Hypertrm.exe.
3. Enter a new connection, e.g. "Midmark_MONITOR" in the Name field for this New Connection. When finished select "OK".
4. Choose the appropriate "Direct to COMx" in the Connect Using dialog box. Where X = communication port on your computer. When finished select "OK".
5. Set the following settings in the Port Settings dialog box:

   Bits per Second = 9600
   Data bits = 8
   Parity = None
   Stop bits = 1
   Flow Control = None

6. When finished, select "OK".
7. Click on Transfer and select Capture Text. Use the Browse button to select a location to save your work. Example: C:\My Documents\Midmark.TXT
8. From the File menu, choose SAVE.
9. When completed, from the File menu, choose CLOSE.

Whenever you need to capture data from the monitor, connect the cable from the RS232 connector on the Midmark Monitor to the computer and open the "Midmark_MONITOR" application in the HyperTerminal program. Click on Transfer and select Capture Text. When the Capture Text box opens, click the START pushbutton.

(1) HyperTerminal by Hilgraeve, Monroe Michigan USA. Copyright 1999 Hilgraeve Inc.

Refer to Page 52, HISTORY for information on the Trend and Alarm History menus. When the "Printing" message appears on the monitor, a data dump can be observed on your PC display.

All subsequent readings will also be captured when the connection remains active.

Once you have the file captured, the data can be viewed and printed by using a standard Windows application such as Word.

NOTE:
Capturing data to an existing file will append new data to the end of the file.

10. CLEANING

CLEANING OVERVIEW

WARNING:
Do not, under any circumstances, perform any testing or maintenance on the monitor while the monitor is being used to monitor a patient. The monitor must be turned "OFF". Unplug the monitor from the AC power source and remove the internal battery.

CAUTION:
Do not open the monitor to clean or repair it. Contact CAS Medical System for service needs.

CAUTION:
Disconnect all accessories from the monitor before cleaning. Do not immerse any part of the electrical connector of the cable or accessories in the cleaning or disinfection solution at any time. Do not use an abrasive cloth or cleaner on the accessories.

Immersing the patient cable or leadwires in any liquid may result in moisture entering. This may cause internal damage and reduce the product life. Alcohol and organic solvents may cause stiffness and brittleness.

THE MONITOR

On a daily basis, examine the monitor's case for any damages and check the AC power cord for bent or broken prongs, cracks or fraying. Neither the monitor nor the power cord should be used if damaged. If any damage is noted, contact the appropriate service personnel.

CAUTION:
Do not spray or pour any water or cleaning solution directly onto the monitor.

As needed, clean the monitor using a soft cloth dampened with a mild dishwashing detergent solution and gently rub the soiled area until clean. Use a clean soft cloth to dry the monitor. Do not use abrasive cleaners on the monitor. Do not use either isopropyl alcohol or solvent to clean the monitor. Use of these cleaners can cause damage to the monitors' surface. Do not immerse the monitor or power cord in the cleaning solution.

When necessary, the monitor surfaces may be disinfected using a soft cloth saturated with a 10% (1:10) solution of chlorine bleach in tap water. When all of the surfaces have been disinfected, wipe the entire surface of the monitor using a soft cloth dampened with fresh water to remove any trace amounts of residue and/or fumes.

NOTE:
Thoroughly wipe off any excess cleaning solutions. Care should be taken to prevent water or cleaning solution to run into connector openings or crevices.

THE DISPLAY

CAUTION:
Use care when cleaning the display. Scratches may occur.

Occasionally, as needed, clean the display window using a soft, lint-free cloth sprayed with an alcohol free glass cleaner. Do not use either isopropyl alcohol or solvent to clean the display. Use of these cleaners can cause damage to the display. The use of paper towels is not recommended as it may scratch the surface.

PATIENT CABLE AND LEADWIRES

Prior to each patient use, inspect the patient cable and leadwires for damage. As necessary, clean the patient cable and leadwires using a soft cloth dampened with a germicidal solution.

PRINTER

When the printer becomes dirty, wipe with a soft dry cloth. For extreme dirt buildup, soak a cloth with mild detergent, wring well and wipe. Dry by wiping with a soft dry cloth.

CAUTION:
Before cleaning the printer, disconnect the AC adapter from the printer.
Do not use volatile chemicals such as thinner, benzene, etc.
Never wet the inside of the printer mechanism.

Refer to the printer User's Manual for more information.

SENSOR AND CLIPS

CAUTION:
To avoid damage to the VetSat sensor, remove it from the clip before cleaning either piece.

CAUTION:
Do not sterilize the sensor or clips by irradiation, steam or ethylene oxide. Do not immerse the sensors in water or cleaning solution.

When necessary, the sensor may be surface-cleaned by wiping it with an agent such as 70% Isopropyl Alcohol.

The clip may be cleaned by either wiping it with, or soaking it for ten (10) minutes in, 70% Isopropyl Alcohol. If the clip is soaked, be sure to rinse it with water and air-dry it prior to use on the next patient.

After each cleaning and prior to each use, inspect the sensor and cable for fraying, cracking, breakage, or other damage. Inspect the clip for cracking or breakage, or loss of spring tension that would allow slippage or movement of the sensor from its proper position.

NOTE:
If defects are noted, do not use the sensor or clip.

Refer to the Directions For Use pamphlet enclosed with the sensor for more information.

TEMPERATURE PROBES
(Reusable)

As necessary, the probes should be cleaned with a mild detergent and water to remove excess bioburden. When necessary, the probes may be disinfected using a soft cloth saturated with a 10% (1:10) solution of chlorine bleach in tap water or 70% isopropyl alcohol. When all of the surfaces have been disinfected, wipe the entire surface of the monitor using a soft cloth dampened with fresh water to remove any trace amounts of residue and/or fumes.

11. MAINTENANCE

MAINTENANCE INTERVALS

Preventive maintenance of the monitor is an important function that should be performed routinely by the user to ensure safe and efficient monitor operation. CAS Medical Systems recommends that you do the following:

The Midmark Monitor:

- Replace the Battery Pack once every two (2) years.

ECG/Respiration:

- No user calibration is required.
- Perform a Bench Test once (1) per year or when there is doubt about the validity of the ECG and/or Respiration readings.

For monitors with SpO_2:

- No user calibration is required.
- Perform a SpO_2 Simulator Check once (1) per year or when there is doubt about the validity of the SpO_2 readings.

Temperature:

- No user calibration is required.
- Perform a Temperature Calibration Check once (1) per year or when there is a doubt about the validity of the temperature readings.

If the monitor is in need of repair, it must be referred to the appropriate service personnel. Service performed by unauthorized personnel could be detrimental to the monitor and may void the warranty.

For service, contact CAS Medical Systems, Inc.

SERVICE MENU

WARNING:
Do not enter the Service menu while the monitor is connected to a patient. The patient is not being monitored while in the menu.

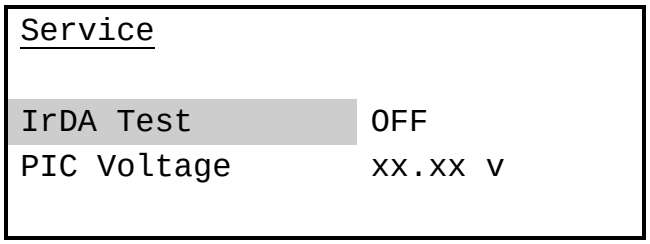
The monitor's Service menu allows the user to perform basic preventative maintenance and testing to the Midmark Monitor. Once entered, the user can:

- Perform a IrDA Print Test
- Verify the monitor's operating power supply voltage level
- Review the monitor's operating and internal modules software levels

ENTERING THE SERVICE MENU

To enter the monitor's Service menu, depress and hold the PARAMETERS and HISTORY pushbutton keys while the monitor is being turned "ON".

Figure 25: **Service Menu**



NOTE:
While in the Service menu, if no pushbutton is depressed within 15 minutes, the monitor will automatically exit the Service menu and return to the Main display screen.

EXIT THE SERVICE MENU

When you have completed testing the monitor, press the MAIN pushbutton to exit and return to the Main display screen.

IrDA TEST

The Midmark Monitor incorporates a test to check the alignment of the monitor to the printer using the Infrared port.

To use the Infrared Test, follow the following procedure:

1) First enter the monitor's Service menu. Refer to Page 90, SERVICE MENU. The IrDA Test menu selection is highlighted.
2) Press one of the NEXT programmed pushbutton keys until the cursor displays the current setting of the IrDA Test.
3) Press either the ARROW UP or ARROW DOWN pushbutton to change the setting from "OFF" to "ON". The message "Printing" will be displayed, in the Equipment Message Window, as a status indicator that the test is active. The test will continue for sixty (60) seconds or can be terminated by the user.
4) When the Infrared windows are properly positioned, the printer will begin to print a series of "A" characters.
5) When the test is completed, press one of the PREVIOUS programmed pushbutton keys to cancel the test and return to the IrDA Test menu selection.
6) Press the ARROW DOWN pushbutton to continue to the next parameter test or press the MAIN ↵ pushbutton to exit to the Main display screen.

PIC VOLTAGE

The Midmark Monitor displays the dc voltage level being received by the PIC processor from the Power Supply Board.

NOTE:
The monitor must be connected to the AC Line wall outlet to view this voltage level.

To view the PIC Voltage level, follow the following procedure:

1) First enter the monitor's Service menu. Refer to Page 90, SERVICE MENU.
2) Press the ARROW DOWN pushbutton until the parameter PIC Voltage is highlighted.
3) Verify the value on the display to be 12.00 V +/- 0.50.

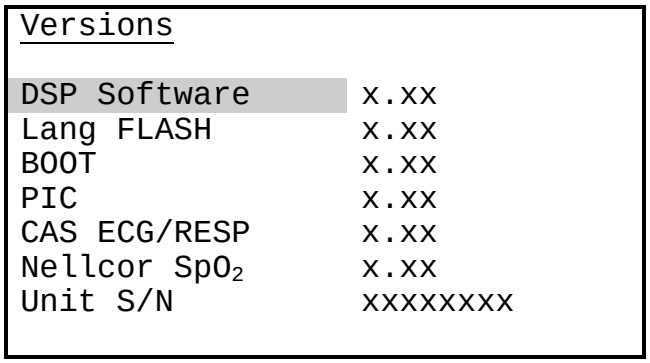
NOTE:
The information provided is read only. No changes can be made.

4) When you have completed, press the MAIN ↵ pushbutton to exit and return to the Main display screen.

SOFTWARE VERSIONS

The Midmark Monitor displays the current software revision of its operating system and that of the internal modules being used inside. The software versions are displayed in the following order:

Figure 26: **Software Versions Menu**



NOTE:
In the Model 9456 monitor, the selection for Nellcor SpO_2 is skipped.

To view the software Versions menu, follow the following procedure:

1) First enter the monitor's Service menu. Refer to Page 90, SERVICE MENU.

2) Depress and hold the HISTORY pushbutton for two (2) seconds to display the Versions menu.

NOTE:
The information provided in the Versions menu is read only. No changes can be made.

3) When you have completed, press the MAIN ↵ pushbutton to exit and return to the Main display screen.

TEMPERATURE CALIBRATION CHECK

Verify the calibration of the monitor's Temperature circuit, once (1) every year.

To perform a Temperature Calibration Check, obtain a Temperature Test Jack. This Test Jack can be purchased directly from CAS Medical Systems or assembled by a service personnel. Refer to Section 12, ACCESSORIES for part number information.

The Temperature Test can be performed, at any time.

CAUTION:
Do not perform a Temperature Test while the Midmark Monitor is monitoring a patient.

To perform a Temperature Test, follow the following procedure;

1) If installed, remove the temperature probe connector completely from the TEMP connector.
2) Insert the Temperature Test Jack into the TEMP connector.
3) The TEMP display value should read 37.0 +/- 0.1 °C or 98.6 +/-0.1°F.

NOTE:
The monitor will display the Temperature Test Jack value using the current temperature units selected.

4) Once completed, remove the Temperature Test Jack from the TEMP connector.

SpO_2 CALIBRATION CHECK

The oximeter is factory calibrated to determine the percentage of arterial oxygen saturation of functional hemoglobin. No user calibration is required.

REPLACING THE MONITOR BATTERY

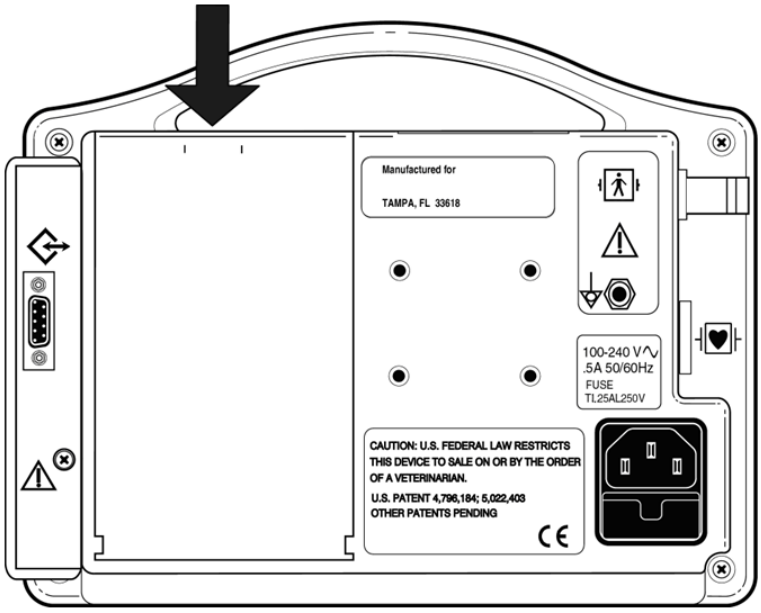
A part number for the battery can be found in the Accessories section of this manual or on the label located on the inside panel of the battery pack. When the battery fails to hold a charge it will need to be replaced.

CAS Medical Systems recommends the battery be changed every two (2) years.

REMOVING THE BATTERY

1) Turn the monitor “OFF” and disconnect the power cord from the back of the monitor.
2) Push down on the battery latch to unlock the battery door from the rear panel of the monitor.
3) Carefully remove the battery pack from the rear panel of the monitor. Refer to Figure 27.

Figure 27: **Removing the Monitor Battery Pack**



INSTALLING THE BATTERY

1) Align the Battery Pack guides with the bottom of the monitor.
2) Slowly close the battery door to ensure the connector in the monitor and the connector on the battery pack mate together.
3) Lock the battery door closed.

Refer to Page 66, BATTERY POWER for additional battery information.

WARNING:
Do not disassemble the battery pack or batteries. The batteries contain electrolytes, which can cause injury to eyes, skin and clothing.

NOTE:
When the battery pack is re-inserted, the monitor will automatically turn “ON”.

NOTE:
This product contains a rechargeable battery that is recyclable. Under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream. Check with your local authorities for instructions on recycling options in your area.

CHANGING THE FUSES

The Midmark Monitor uses a dual fuse power input receptacle. The receptacle incorporates fuses in the hot and neutral AC input lines that are user serviceable.

The two (2) fuses for the Midmark Monitor are each rated at 250V, 500mA or 1.25A, 5 x 20 mm, Slow Blow (CAS p/n 09-01-0002 or 09-01-0034 respectively). Refer to rear panel monitor labeling for actual fuse rating.

CAUTION:
For continued protection against fire hazard, replace only with identically rated fuses.

A fuse may need to be replaced if the monitor is plugged into an electrical outlet but the Battery Power Visual Indicator is not illuminated the color Green.

WARNING:
Before changing the fuse, unplug the power cord.

The fuse holder is incorporated into the power input receptacle and located under the power cord input connector.

To replace fuses:

1) Turn the monitor “OFF” and disconnect the power cord from the back of the monitor.
2) Depress down on the locking tab, which holds the fuse holder in the power input receptacle.
3) While holding down on the tab, pull the fuse holder out.
4) Remove the fuses.
5) Place new fuses directly into the fuse holder.
6) Insert the fuse holder into the power input receptacle. There should be an audible “click” when it is secure.

STORAGE

WARNING:
If it becomes necessary to store the monitor for longer than six (6) months, remove the monitor's battery pack and place the monitor in its original packing container if available.

WARNING:
Use of unapproved batteries will invalidate the product's warranty and may result in serious safety consequences for the patient and user.

See Section 13, SPECIFICATIONS for storage temperature information.

12. ACCESSORIES

ECG/RESPIRATION

Catalog No.	Description
01-02-0304	3-Lead Patient Cable, 3 meter, IEC/AAMI Color Coding
01-02-0305	5-Lead Patient Cable, 3 meter, IEC/AAMI Color Coding
01-02-0306	3-Lead Wire set w/crocodile clips (black, white, red)
~~01-02-0307~~ (No longer available)	5-Lead Wire set w/crocodile clips (black, white, red, green, brown)

OXIMETRY

Note: Use only with Nellcor® Pulse Oximeter Accessories

Catalog No.	Description
01-02-0183	Patient Interface Cable, DOC-10, 10 FT
01-02-0299	VetSat® SpO_2 Sensor and Clips

TEMPERATURE

Catalog No.	Description
01-02-0327	Esophageal/rectal reusable probe, 9 Ft
28-02-0444	Temperature Adapter Plug

OTHER ACCESSORIES

Catalog No.	Description
01-02-0174	Carry Bag
01-02-0188	Printer Battery
01-02-0189	Printer, includes Battery, RS232 Cable, Power Supply, One (1) Roll of Paper and Manual
01-02-0243	Universal Mounting Kit
01-02-0266	Printer Power Supply Adapter Plug, European
01-02-0267	Printer Power Supply Adapter Plug, UK
01-02-0268	Printer Power Supply Adapter Plug, Australian
01-02-0297	Roll Stand with Basket and Quick Release
~~01-02-0300~~ (No longer available)	Printer Mount Attachment for Monitor
01-02-0301	Printer Bracket Attachment for Roll Stand
01-03-0225	Electrode Gel
01-04-0016	U.S.A. Power Cord
01-05-0144	International Power Cord IEC320 European Plug
03-08-0450	Monitor Battery Pack (7.2 VDC, 3700 mAhr)
18-04-0004	Australian Power Cord
18-04-0010	U. K. Power Cord
21-02-0187	Midmark Monitors Model 9454 and 9456 User's Manual
28-02-0077	Printer Paper (1) Roll
28-02-0445	Leadwire Detangler

MONITOR CONFIGURATIONS

Table 10: **Monitor Configurations**

Model	Description
9454	ECG, Respiration and Temperature, and Nellcor® Veterinary SpO_2, 100-240V, 50/60HZ, AC Power Supply and Battery
9456	ECG, Respiration and Temperature, 100-240V, 50/60HZ, AC Power Supply and Battery

13. SPECIFICATIONS

ECG

Characteristic	Specification
Input:	3 or 5 leads
Selectable Leads:	I, II, III, aVL, aVR, aVF, V
Gain:	X1, X2, X4, X8, Auto
Display Sweep Speeds:	12.5, 25, 50 mm/Sec
QRS Tone Volume:	User-selectable: 5 settings, Off
Frequency Response:	0.5 to 25 Hz
Sensitivity Adjustment:	Automatic
Minimum Signal:	0.20 mV peak-to-peak
Common Mode Rejection:	>90dB
Loose Lead Threshold:	2.0 to 2.5 K ohms
Pacemaker Spike Rejection:	Meets AAMI Standards

HEART RATE

Characteristic	Specification
Asystole Detection:	4 seconds
Alarms:	User-selectable: low heart rate and high heart rate
Alarm Delay Time:	5 seconds
Numeric Resolution:	1 BPM
Accuracy:	+/- 3 BPM or +/- 3%, whichever is greater
Numeric Range:	0, 15 – 300 BPM averaged, 1 second update

RESPIRATION

Characteristic	Specification
Detection Technique:	Impedance Pneumography
Sensing Electrodes:	LA-RA
Bandwidth:	0.05 to 2.5 Hz
Sweep Speed:	3, 6.25, 12.5 mm/Sec
Sense Frequency:	63 kHz
Sensitivity Adjustment:	Automatic
Trigger Level:	Minimum trigger at 0.20 ohm.
Respiration Rate Numeric:	0 to 150 BrPM averaged, 1 second update
Accuracy:	0 to 122 BrPM +/- 1 BrPM 123 to 150 BrPM +/- 2 BrPM
Numeric Resolution:	1 BrPM
Alarms:	User-selectable: low and high respiration rate
Base Impedance Range:	0 to 3.5 K ohms at 63 kHz

TEMPERATURE

Characteristic	Specification
Input:	YSI® 400 compatible
Temperature Range:	28 to 43 °C (82.4 to 109.4 °F)
Accuracy:	+/-0.1°C (+/-0.2°F)
Resolution:	0.1°C or 0.1°F

%SpO_2 MEASUREMENT

Characteristic	Specification
Nellcor® *OxiMax*®	
Type:	Functional Oxygen Saturation
SpO_2 % Range:	0 - 100%
SpO_2 Accuracy:	70 - 100%, +/-2 digits (1 S.D.) Adult
	70 - 100%, +/-3 digits (1 S.D.) Neonate
Measurement Wavelengths:	Red 660 Nanometers
	Infrared 890 Nanometers
Power:	Not exceeding 15 mW
Pulse Rate Range:	20 - 300 BPM
Pulse Rate Accuracy:	+/-3 digits
Numerics:	Updated every one (1) second.

NOTE:
Accuracy is specified for adult human hemoglobin measured at the fingertip. Although animal hemoglobin has similar optical characteristics, other types of hemoglobin may affect the accuracy.

PATIENT ALARMS

	9456		9454	
Patient Parameters				
	Low Limit	High Limit	Low Limit	High Limit
Heart Rate:	25 – 295 BPM	25 – 295 BPM	25 – 295 BPM	25 – 295 BPM
Respiration Rate:	5 – 145 BrPM	5 – 145 BrPM	5 – 145 BrPM	5 – 145 BrPM
% SpO_2:			70 – 95 %	80 – 99 %
SpO_2 Pulse:			25 – 295 BPM	25 – 295 BPM

NOTE:
Each alarm limit may also be selected “OFF” individually or as a whole.
Low Limits cannot be set above the associated High Limit.
High Limits cannot be set lower than the associated Low Limit.

CONTROL PANEL

Characteristic	Specification
Display:	LCD display of measurement results, instructions, troubleshooting messages, waveforms and signal strength bar.
Parameters Displayed:	Heart Rate
	Respiration Rate
	%SpO_2
	Pulse Rate
	Temperature (in Fahrenheit or Celsius)

OPERATING MODES

Characteristic	Specification
Patient:	Veterinary
ECG:	Continuous Monitoring
History:	Trend: Review of previous measurements
	Alarm: Review of previous alarms
%SpO_2:	Continuous Monitoring
Temperature:	Continuous Monitoring

POWER

Characteristic	Specification
Source:	External line or internal battery
AC Power Option:	100 - 240 VAC, 50/60 Hz, 0.5A; Fuse Rating – T500mAL250V or T1.25AL250V (two provided). Refer to rear panel monitor labeling for actual fuse rating.
Battery:	Nickel Metal Hydride (NiMH) battery pack (user removable)
	Charge Time: 3 - 5 hours
	Operation on battery: Approximately four (4) hours. Based on a Model 9454.
Leakage Current:	100 microamp (maximum)

FEATURES

Characteristic	Specification
Self Test:	System self test is performed each time power is turned on.

OPERATING ENVIRONMENT

Characteristic	Specification
Operating Temperature:	0°C to 50°C (32°F to 122°F)
Humidity:	15 - 95%, non-condensing
Altitude:	10,000 to –1,000 ft (690 – 1050 hPa)
Storage / Transport Temperature:	-20°C to 65°C (-4°F to 149°F)
Humidity:	15 - 95%, non-condensing
Altitude:	10,000 to –1,000 ft (690 – 1050 hPa)

Monitors may not meet performance specifications if stored or used outside temperature and humidity ranges. When moving the monitor from a storage location, wait at least one-hour prior to use to allow the monitor to adjust to room temperature.

PHYSICAL DIMENSIONS & WEIGHT

Characteristic	Specification
Base Unit	
H x W x D:	6.75 in x 8.5 in x 4.0 in
	(17 cm x 21.5 cm x 10.2 cm)
Weight:	4.1 lbs approx. (1.4 kg)

SERIAL INTERFACE

Characteristic	Specification
Speed:	9600
Interface:	Bidirectional serial communication
Signal Level:	RS232C
Data Length:	8 bits
Start Bit:	1 bit
Stop Bit:	1 bit
Parity:	None

STANDARDS

Units comply with the following requirements:

EN 60601-1
EN 60601-1-2
EN 60601-2-30
EN 60601-2-49
EN 865
UL Classified - UL 2601-1, CAN/CSA C22.2 No.601.1. If so marked

Nellcor®, VetSat® and OxiMax® are registered trademarks of Mallinckrodt Inc.
SatSeconds™ is a trademark of Mallinckrodt, Inc.

YSI® is a registered trademark of Yellow Springs Instrument Company

CASMED®, MAXNIBP®, Tuff-Cuff®, Safe-Cuff®, SoftCheck®, UltraCheck® and "*FOR WHAT'S VITAL*" are registered trademarks of CAS Medical Systems, Inc.

All units covered by U.S. patent 4,796,184 and 5,022,403. Other patents pending.

Monitors are CE if so marked.

14. PURCHASING RECORD

Midmark VITAL SIGNS MONITOR

Installed Options: ECG/Resp & Temp ( ) SpO_2 ( )

Model: 9454 ( ) ; 9456 ( )

Serial Number: _____

Date of Purchase: _____

Distributor Name: _____

Representative: _____

Phone Number: _____

Fax Number: _____

Email: _____